

REHABILITATION REPORT

for the

GREYSTONE RESERVOIR

within the City of

BEVERLY HILLS, CALIFORNIA

PREPARED FOR

**Public Works Capital Assets Department
Beverly Hills, California**

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CHAPTER 1

INTRODUCTION AND SCOPE OF WORK

Background:

Greystone Reservoir is an underground, potable water storage reservoir composed of reinforced concrete located at the Greystone Mansion Compound (Greystone Park). The park is located at the intersection of Doheny Road and Loma Vista Drive and has the address 501 Doheny Road (905 Loma Vista Drive). This reservoir was constructed in the late 1960s with a dividing wall separating the eastern and western tanks. The total storage capacity of this reservoir is 19.4-million gallons (9.2-million gallon storage capacity at the east basin and 10.2-million gallon capacity at the west basin). Each basin can operate independently. The floor elevation of this reservoir is approximately 584-feet and the overflow is at 623-feet in elevation. The rooftop of this reservoir is currently being used as a parking lot with landscaping and vegetation planted on its perimeter. There are a few additional planters on the reservoir rooftop.

The City of Beverly Hills Water Department experienced a few instances of water quality problems at this reservoir in 2013. The water quality problems prompted the City to retain KEC Engineers, Inc. to explore the possible and potential contributory factors to the water quality problems.

Scope:

This report constitutes a preliminary evaluation of the deficiencies affecting the safe operation of this reservoir. The deficiencies primarily being: water quality problems, potential leakage, visible structural and safety problems, and factors potentially contributing to the failed water quality test in the past. The objective of the eventual design recommendations will be to restore the reservoir to safe operating conditions and ensure water quality. The following procedure was followed for the preparation of this preliminary study:

1. Identification of the problems currently affecting the reservoir.
2. Evaluation of existing conditions to hone in on the sources of found problems.
3. Examination of the best available data for the reservoir: as-built drawings, inspection reports, etc.
4. Formulation and presentation of possible solutions.
5. Preparation of probable cost estimate.

CHAPTER 2

POTENTIAL CAUSES OF THE WATER QUALITY PROBLEMS AT GREYSTONE RESERVOIR

Findings:

The City drained the west basin of the Greystone Reservoir to allow a close-up physical inspection of the interior of the west basin floors, walls, columns, and concrete joints. After a number of site inspections and closer look at the interior of the reservoir, KEC Engineers determined that there are three factors potentially contributing to the water quality problems at Greystone Reservoir:

1. Existing Joint Sealants (See Figure A).

KEC believes that the existing spongy, elastic (rubber type), sticky, and greyish joint sealants are the most impactful contributor of the causes of the water quality problems in this reservoir. The rubber sealants were installed in the reservoir's construction joints during its initial construction. Some segments of the sealants have completely separated, and are just laying on top of, or next to the joints. Many segments of the joint sealants can be peeled off by hand. The condition of these joint sealants presents several problems:

- The sticky nature of the joint sealants indicates that these sealants never cured at the time of installation to be effective in sealing the joints.
- The spongy nature of the sealants allows water to penetrate inside the sealant, and the stale water inside the rubber sealant becomes the source of bacteria growth over time. Joint sealants in potable water reservoirs cannot be spongy or allow water penetration.
- There is evidence of mold growing on the inner side of some sealants which proves the growth of the bacteria on the inside and outside surface of the joint sealants.
- The loose nature of the sealants allows silt to settle inside the construction joints allowing bacteria growth.
- Due to lack of available information on the joint sealants' Materials Safety Data Sheets (MSDS), KEC is not able to determine if the joint sealants are NSF 61 approved.

Causes of Joint Sealants' Failure:

KEC assumes that the joint sealants were installed under high humidity conditions inside the tank, and they never reached their curing point which is the reason why they are sticky (gummy) and why they are peeling off. After KEC's initial site inspection of the reservoir, it was apparent the joint sealants need to be replaced. The specification of new joint sealants would require measurement of the relative humidity level inside the tank and the effort required dropping the humidity level to an acceptable level (75%). KEC retained George Donnelly Testing and Inspection Services to install ten R-H10 Humidity Probes embedded inside the reservoir concrete walls and floor to measure the relative humidity level, which was found to be at 99%. The complete report provided by George Donnelly Testing and Inspection Services can be found in Appendix C. KEC then hired Dryco to install three DH-5000 dehumidification units with five air movers to dry the inside of the reservoir and establish a baseline for the time required to drop the humidity level to 75%. Due to nighttime noise restrictions imposed by the City (due to close proximity of residences), the dehumidifier units could only operate between the hours of 8:00 AM and 6:00 PM. After five ten-hour days of running the dehumidification units and measuring the relative humidity, there was no change in the humidity level of the concrete floor or concrete walls.

2. External Irrigation/Rainwater Penetration into the Reservoir (See Figure B).

- There are two valve covers with valve stems extending from the rooftop to the bottom of the tanks. These rooftop valve stem penetrations are not totally sealed, and during our field investigation we detected rain/irrigation water seeping inside the reservoir through the valve stem. The penetration was acknowledged and confirmed by the City's operational staff present during the site inspection.
- There is evidence of ponding water (both irrigation and rainwater) on the rooftop. In addition, the settlement in the vicinity of the reservoir perimeter walls indicates that the surface water has penetrated into the soils and may have entered the reservoir through the perimeter wall joints.
- The rooftop surface above Greystone Reservoir was not originally designed to be used as a parking lot. Without taking a few core samples, it is hard to evaluate how much dead load (asphalt concrete) is added to the reservoir rooftop. Furthermore, the existing pavement overlay is not adequately graded to prevent the ponding of water on the reservoir rooftop. Such condition may result in rooftop irrigation or rainwater entering the reservoir through the roof slab joints.

3. Aged Water inside the Reservoir.

- Greystone Reservoir receives chloraminated water from the Metropolitan Water District. Typically, potable water storage tanks should cycle every

twenty-four hours to keep the water fresh and safe. If the water is not cycled regularly due to low water demand, the chlorine in water will dissipate due to evaporation and interaction with bacteria in the water. Thus, extended water residence time in a reservoir will cause nitrification in drinking water and loss of free chlorine which would otherwise continuously disinfect water of bacteria (see Appendix B). The City introduces free chlorine at this reservoir and has a "Solar Bee" mixer to circulate water inside the reservoir. However, it is hard to thoroughly circulate the water inside such a large reservoir; therefore, the water quality may be compromised by not being cycled more frequently.

CHAPTER 3

NON-WATER QUALITY RELATED ISSUES AT GREYSTONE RESERVOIR

Structural (See Figure C):

Although the focus of this study was not related to the structural integrity of this Reservoir, it must be acknowledged that there are sporadic and visible rust markings on the reservoir walls and columns that relate to interior corrosion of steel reinforcement at these locations.

The State of California, Department of Water Resources, Division of Safety of Dams (DSOD) conducted an inspection of this Reservoir in 2011(See Appendix E) and concluded, after walking down the stairs to the water level, that the east and west sections appeared in good condition.

Reservoir Overflow:

The reservoir overflow outlet is below ground, inside the vault. The overflow outlet has to be above ground with a minimum 1-foot separation (air gap) to the highest 100 year flood level. Being inside the vault is considered a cross connection and does not meet the current Department of Public Health (DPH) Standard. If inspected by the DPH, a non-compliance notice will be issued.

Reservoir Vents (See Figure D):

Based on the original reservoir design and record drawings, there are four roof-vents (two at each basin). However, none of those four roof-vents are currently visible above ground and appear to have been sealed off and buried under the current parking lot asphalt.

Water Quality Sampling Points:

There are no existing hose-bibs or water quality sampling points at Greystone Reservoir to take water samples from either basin. Operational staff currently obtain water samples by standing on top of the staircase and casting a bottle in the Reservoir.

Water Level Indicator (See Figure E):

Each basin has a staff gauge on the side of a column that has to be read manually by entering inside the reservoir access door and looking below the staircase.

Valving and Reservoir Inlet/Outlet Pipelines & Float Wells (See Figures F and G):

All of the valves and inlet/outlet pipes are corroded.

Rooftop Changes (See Figure H):

The reservoir rooftop is currently being used as a parking lot with planters, irrigation system, and landscaping in a few areas. The original reservoir rooftop on As-Built Drawings prepared by MWH in 1967, does not show a parking lot on the rooftop. The as-built drawings for the reservoir show an approximate three-foot thick earth blanket over a typical top of wall elevation of 628-feet. Department of Water Resources, DSOD has recommended a maximum three-ton load over the existing reservoir. However, there are no structural calculations to validate the allowable load (of pavement and traffic) on the rooftop.

Rooftop Drainage, Sidewalk, Curb & Gutter, and Pavement Repairs (See Figures I, J, K, and L):

There are substantial cracks in the existing parking lot pavement, broken and settled sidewalks, and broken curb and gutter sections.

Possible Broken Sprinkler or Excessive Watering (See Figure H):

Based on the visible cracks or settlement in the sidewalks, curbs and gutters, and ponding of water in some areas of the roof top during dry weather, it appears that some planters in the parking lots may be overwatered or have leaking irrigation pipes.

CHAPTER 4

RECOMMENDATIONS AND PROBABLE CONSTRUCTION COST

	<i>Description of Work</i>	<i>Duration of Construction</i>	<i>Estimated Engineering & Construction Costs</i>	<i>Remarks</i>
PRIORITY 1	<p>1-Removal of the existing joint sealant, sandblasting, and cleaning the joints and applying Sika (primer 429 and Sikaflex-2c NS EX Mix) joint sealant to seal the joints.</p>	<p>Preparation of specifications= 8 weeks Construction= 14 weeks</p>	\$650,000	<p>1-This mitigation method is the fastest approach of correcting the main source of water quality problem at this reservoir. Also, it could be completed without taking the East Basin out of service.</p>
	<p>2-Removal and replacement of the existing corroded valves and piping.</p>	Included in the 14 weeks	\$50,000	<p>2- The City has purchased the valves which can be provided to the contractor for the installation.</p>

	Description of Work	Duration of Construction	Estimated Engineering & Construction Costs	Remarks
PRIORITY 2	3-Sandblasting of the areas of corroded steel reinforcement and replacing or spraying of 8-mil epoxy coating depending on their condition.	6 Weeks	\$100,000	This item covers the visible rusty color areas of the steel reinforcement mostly on the reservoir columns and the wall.
	4-Replacement of the two staff gauges with new ones and addition of an electronic Level-Indicator Transmitter to each basin and connection to City's existing SCADA system.	2 Weeks	\$75,000	The existing staff gauges are rusty and damaged. Furthermore, operational staff have to enter the reservoir and walk down the staircase in order to read the gauge. If the reservoir is full, it is not safe to enter the reservoir to read the gauge. A new LIT will be necessary to provide electronic reading of the reservoir level without entering the reservoir.
	5-Design and construction of two water quality sampling pumps (one for each basin), to allow water sampling without entering the reservoir.	2 Weeks	\$75,000	The new water quality sampling stations will be the proper and safe method of testing the water quality as is required on a regular basis.
	6-Taking 5 core samples of the existing parking lot pavement thickness and performing structural calculations to determine safe and allowable dead-loads and live-loads on the Reservoir roof.	3 Weeks	\$85,000	The original reservoir design does not call out for the rooftop to be used as a parking lot. The structural evaluation of the reservoir will provide the safe load limit for the Greystone Reservoir.

	Description of Work	Duration of Construction	Estimated Engineering & Construction Costs	Remarks
PRIORITY 2	7-Removal of the rooftop planters, or replacement of existing vegetation with drought tolerant plants.	2 Weeks	\$75,000	The removal of the planters or replacement of the planting materials would eliminate the potential for tree root intrusion into the roof cracks or excessive watering to enter the reservoir through hairline cracks.
	8-Reestablishment of the reservoir's roof vents at the rooftops and protection of the new vents by securing the vent areas.	2 Weeks	\$50,000	The replacement of the roof vents will be in accordance with the original design and will provide direct access to each basin without entering through the main access door.
	9-Grinding and re-grading of the rooftop AC to prevent the ponding water on the rooftop.	1 Week	\$75,000	The existing parking lot over the rooftop has many birdbaths and needs to be corrected to prevent ponding rainwater or irrigation water.
	10-Repair and reconstruction of all damaged curbs, gutters, and sidewalk along the perimeter of the reservoir.	3 Weeks	\$100,000	The existing curbs and sidewalks along the rooftop are broken or settled in many spots causing birdbath with stagnant water which is prone to bacteria and algae growth.

	Description of Work	Duration of Construction	Estimated Engineering & Construction Costs	Remarks
PRIORITY 2	11-Reconstruction and rerouting of the existing overflow outlet(s).	3 Weeks	\$100,000	The overflow outlets have to be brought to above ground to prevent potential for cross connection
	12-Testing and disinfection of the reservoir.	2 Weeks	\$50,000	Upon completion of any interior work inside the reservoir, the reservoir has to be disinfected and tested for bacteria prior to placing it in service.
	TOTALS	30 WEEKS	\$1,485,000	

Option 1 (Application of Sika Joint Sealant):

This option involves removal of the existing joint sealants and sandblasting the crevices and joints, then applying Sika Joint Sealant to replace the failed joint sealant. The advantage of this option is that the humidity level is not a factor for the application of Sika. It cures in a short period of time, is cost effective, and is successfully used for this application.

Option 2 (Application of Polyurethane Liner instead of Sika Joint Sealant):

This option requires Removal and replacement of all existing joint sealants, dehumidification of reservoir for an extended period of time to reach 75% relative humidity level, sandblasting of the entire floor and all walls two feet above the reservoir floor, application of 150-mil polyurethane liner to cover the entire floor, and a minimum of two-feet of wall height (above the floor) to key-in the liner. The key to this option is to ensure that the primer for the polyurethane can handle the 99% humidity level in the event that dehumidification of the reservoir becomes cost prohibitive or impossible. The polyurethane must be NSF 61 approved.

Option 2, will cost additional \$500,000; however, it provides a more robust result in sealing the floor joints and has the flexibility to allow minor movement. Use of Sika Joint sealant vs. Polyurethane liner shall be deferred to which manufacturer is willing to provide longer warranty on the joint sealants.

APPENDIX A: SITE INVESTIGATION PHOTOGRAPHS

Figure	Name
A	Floor Sealant
B	Valve Covers
C	Corrosion of Column's Reinforcement
D	Roof Vent
E	Staff Gauge
F	Outlet and Drain Valves
G	Corrosion of Float Well
H	Planter
I	Curb and Gutter at Southwest Corner of West Basin
J	Pavement Cracks at Westerly Basin Wall
K	Pavement Cracks at Southerly Basin Wall
L	Pavement Cracks at Southerly and Easterly Basin Walls

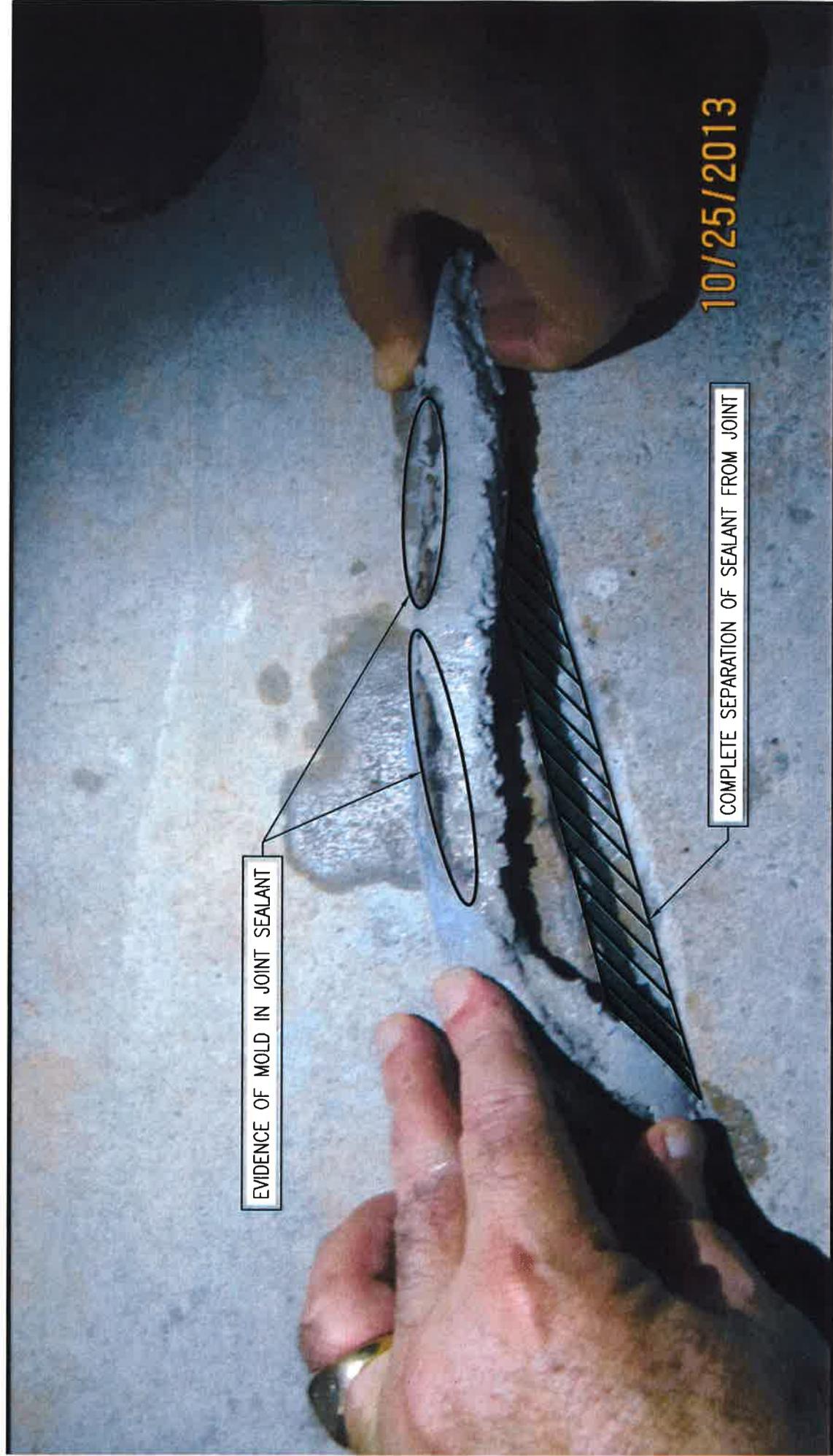


FIGURE A: FLOOR SEALANT

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

SEE SHEET "S-3"

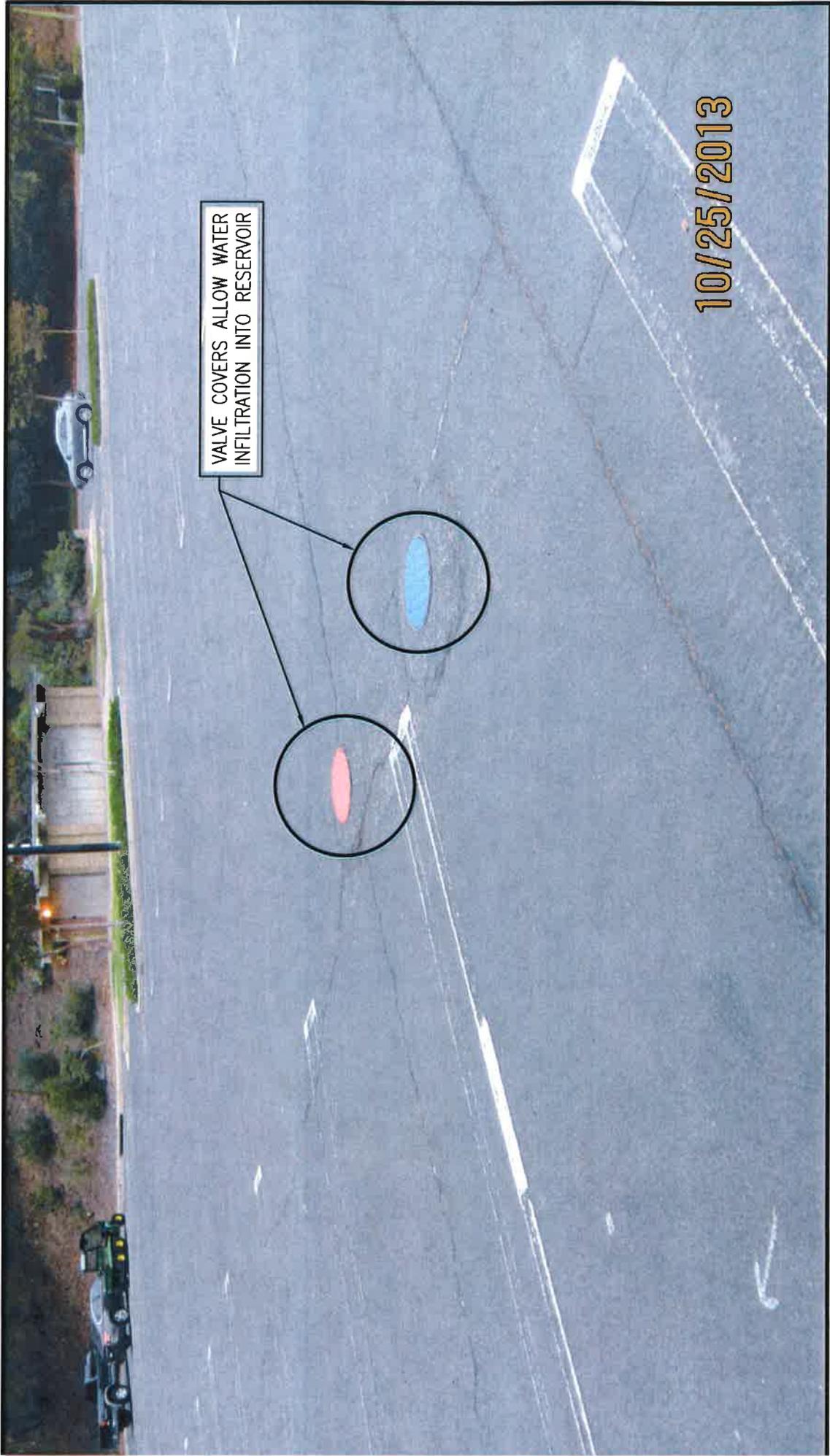


FIGURE B: VALVE COVERS

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

SEE SHEET "C-10"

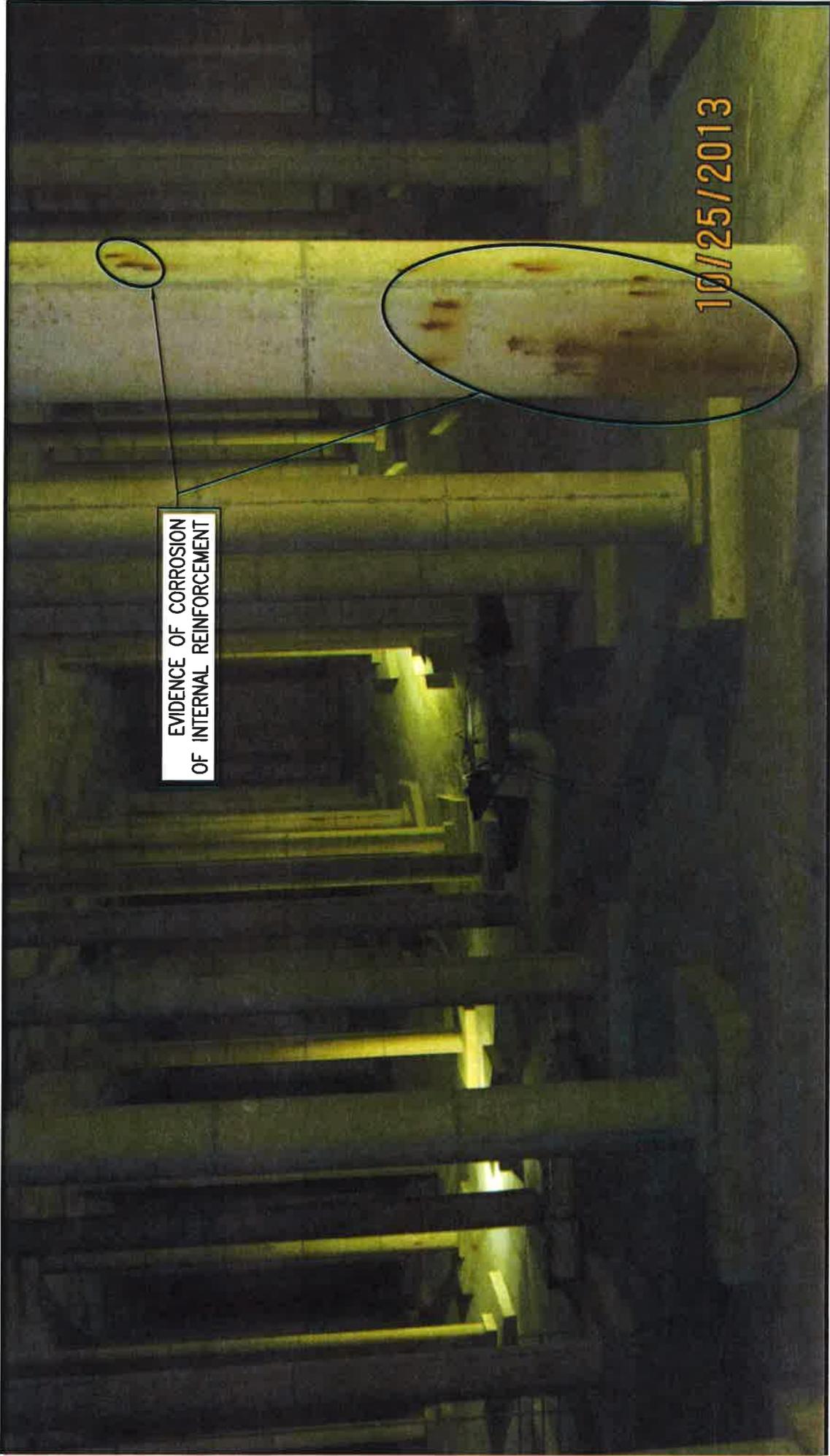


FIGURE C: CORROSION OF COLUMN'S REINFORCEMENT

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

SEE SHEET "S-1"

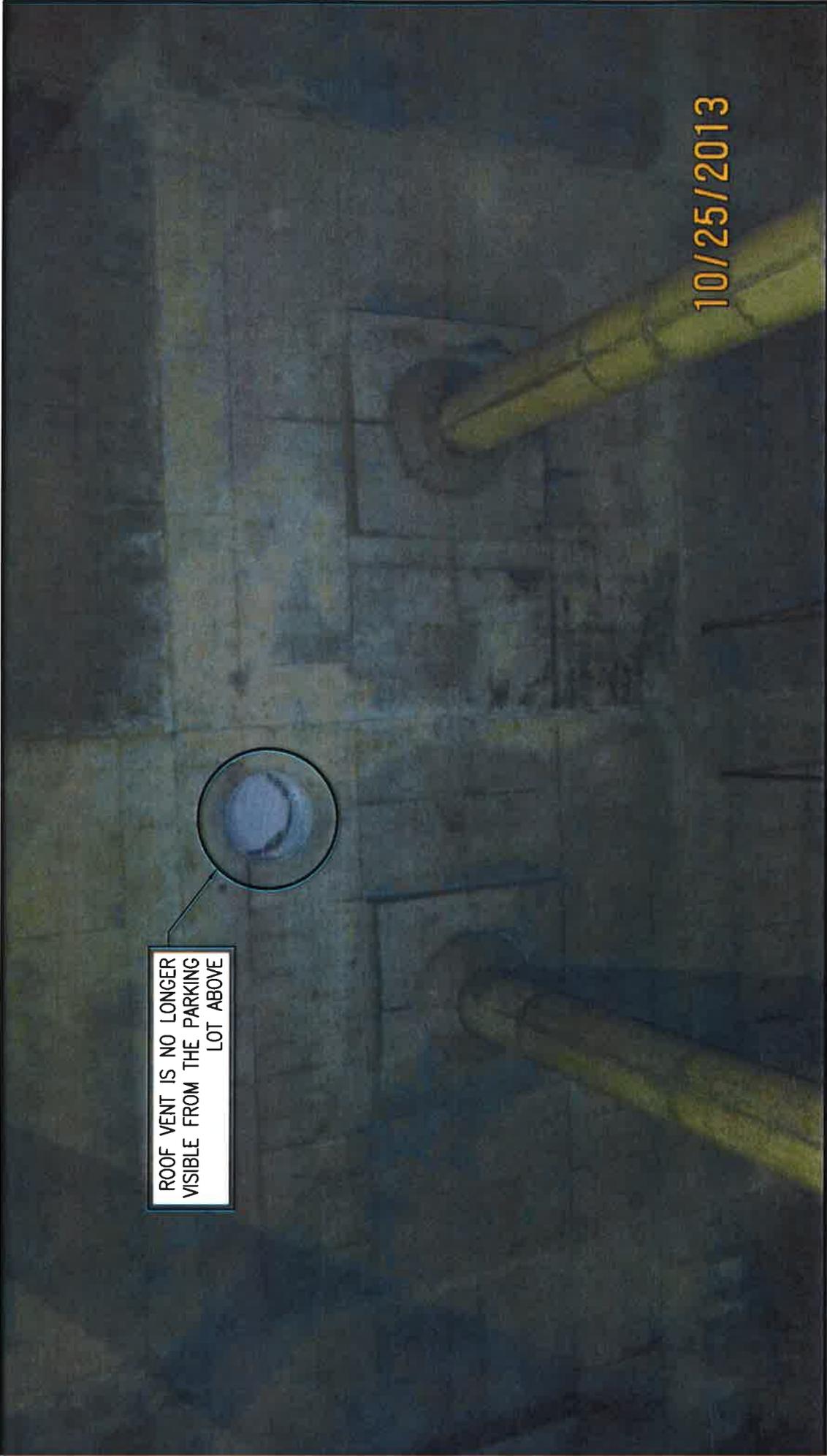


FIGURE D: ROOF VENT

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

SEE SHEETS "S-2" AND "S-11"

EXTENSIVE RUST ON INTERIOR
STAFF GAUGE



FIGURE E: STAFF GAUGE

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

SEE SHEET "S-9"



**FIGURE G: CORROSION OF
FLOAT WELL**

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

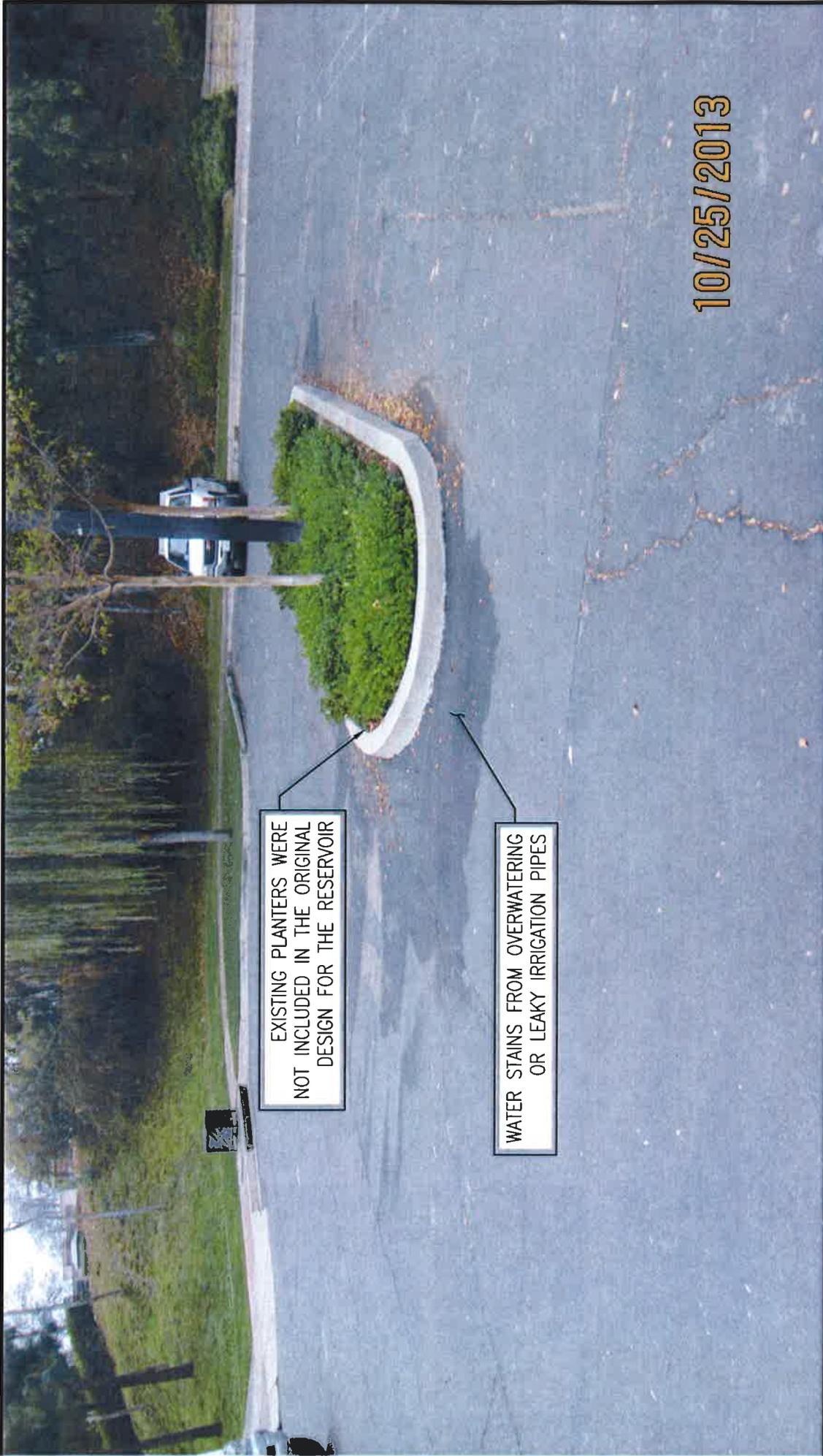


FIGURE H: PLANTER



CURB IS DEPRESSED AND BROKEN

WATER AND DEBRIS ACCUMULATE DUE TO POOR DRAINAGE

10/25/2013

FIGURE I: CURB AND GUTTER AT SOUTHWEST CORNER OF WEST BASIN

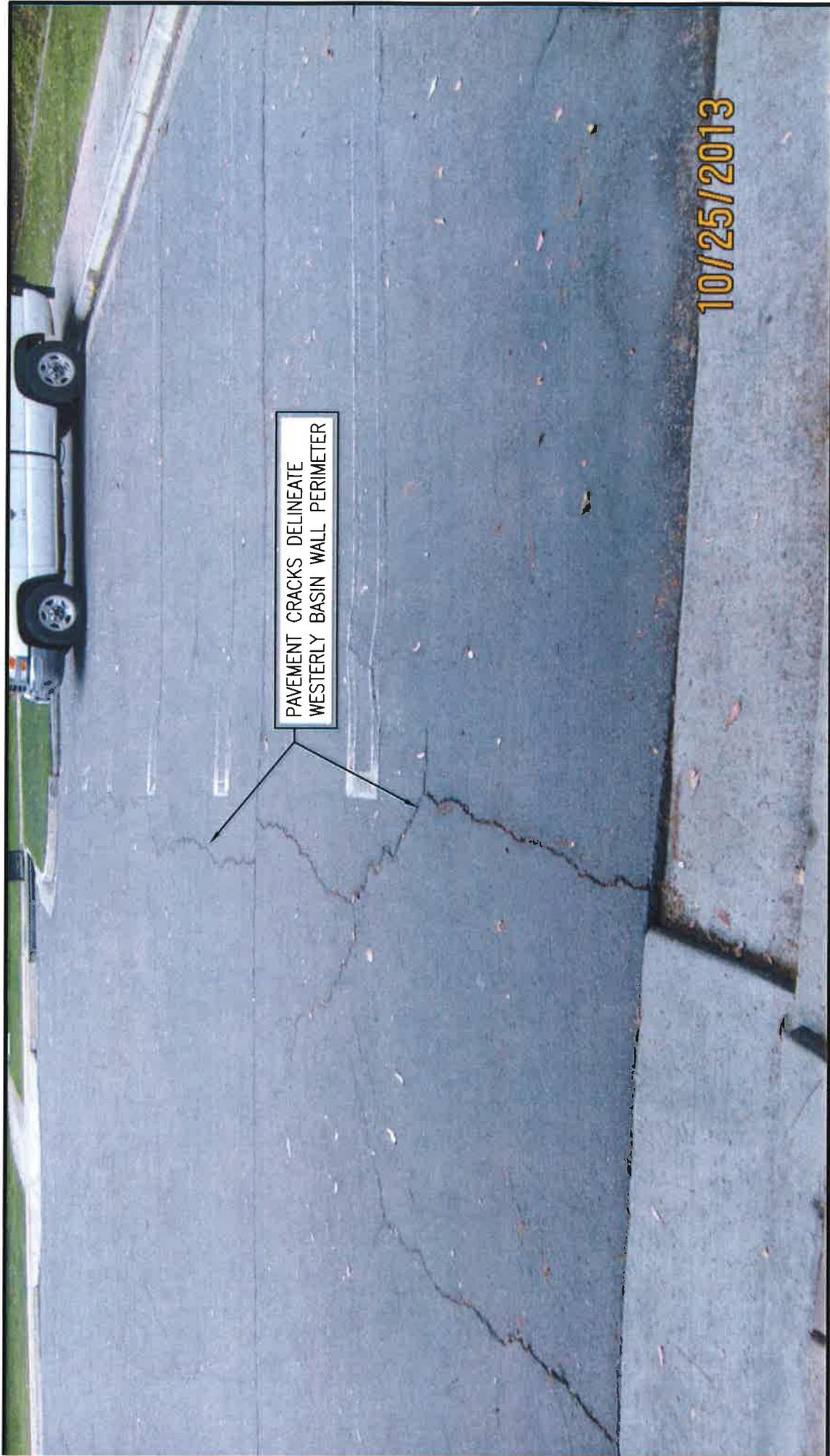


FIGURE J: PAVEMENT CRACKS AT WESTERLY BASIN WALL

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

SEE SHEET "S-2"



FIGURE K: PAVEMENT CRACKS AT SOUTHERLY BASIN WALL

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

SEE SHEET "S-2"

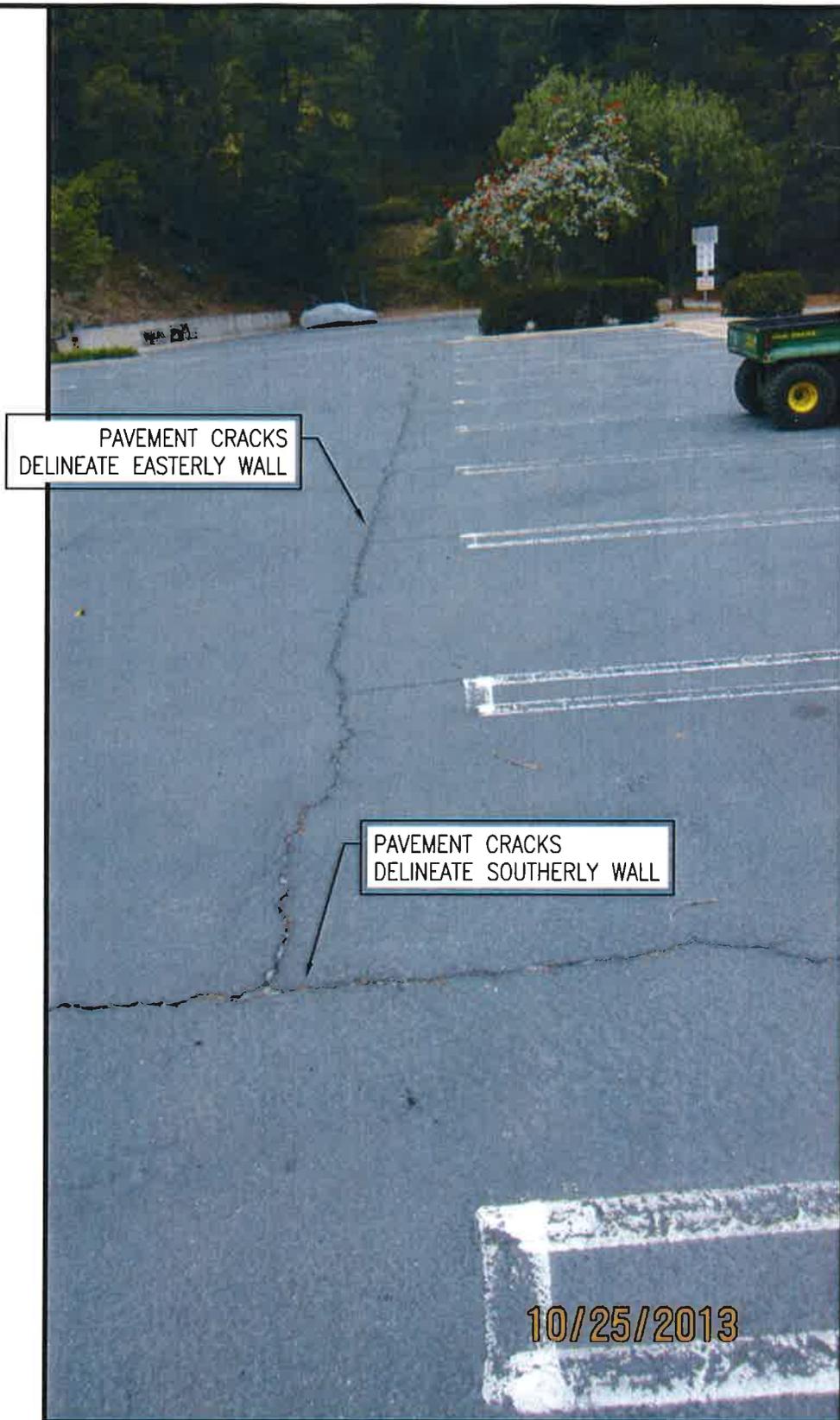


FIGURE L: PAVEMENT CRACKS AT SOUTHERLY AND EASTERLY BASIN WALLS

REFERENCE: "GREYSTONE RESERVOIR AND RELATED FACILITIES" AS-BUILT DRAWINGS
PREPARED BY JAMES MONTGOMERY, CONSULTING ENGINEERS

SEE SHEET "S-2"

APPENDIX B: EPA NITRIFICATION REPORT



Office of Water (4601M)
Office of Ground Water and Drinking Water
Distribution System Issue Paper

Nitrification

August 15, 2002

PREPARED FOR:

U.S. Environmental Protection Agency
Office of Ground Water and Drinking Water
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Background and Disclaimer

The USEPA is revising the Total Coliform Rule (TCR) and is considering new possible distribution system requirements as part of these revisions. As part of this process, the USEPA is publishing a series of issue papers to present available information on topics relevant to possible TCR revisions. This paper was developed as part of that effort.

The objectives of the issue papers are to review the available data, information and research regarding the potential public health risks associated with the distribution system issues, and where relevant identify areas in which additional research may be warranted. The issue papers will serve as background material for EPA, expert and stakeholder discussions. The papers only present available information and do not represent Agency policy. Some of the papers were prepared by parties outside of EPA; EPA does not endorse those papers, but is providing them for information and review.

Additional Information

The paper is available at the TCR web site at:

http://www.epa.gov/safewater/disinfection/tcr/regulation_revisions.html

Questions or comments regarding this paper may be directed to **TCR@epa.gov**.

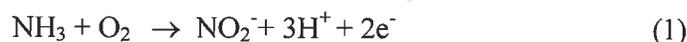
Nitrification

1.0 Introduction

The goal of this document is to review existing literature, research and information on the potential public health implications associated with Nitrification.

Nitrification is a microbial process by which reduced nitrogen compounds (primarily ammonia) are sequentially oxidized to nitrite and nitrate. Ammonia is present in drinking water through either naturally-occurring processes or through ammonia addition during secondary disinfection to form chloramines. The nitrification process is primarily accomplished by two groups of autotrophic nitrifying bacteria that can build organic molecules using energy obtained from inorganic sources, in this case ammonia or nitrite.

In the first step of nitrification, ammonia-oxidizing bacteria oxidize ammonia to nitrite according to equation (1).



Nitrosomonas is the most frequently identified genus associated with this step, although other genera, including *Nitrosococcus*, and *Nitrospira*. Some subgenera, *Nitrosolobus* and *Nitrosovibrio*, can also autotrophically oxidize ammonia (Watson et al. 1981).

In the second step of the process, nitrite-oxidizing bacteria oxidize nitrite to nitrate according to equation (2).



Nitrobacter is the most frequently identified genus associated with this second step, although other genera, including *Nitrospina*, *Nitrococcus*, and *Nitrospira* can also autotrophically oxidize nitrite (Watson et al. 1981).

Various groups of heterotrophic bacteria and fungi can also carry out nitrification, although at a slower rate than autotrophic organisms (Verstraete and Alexander 1973; Watson et al. 1981). Speciations of nitrifying bacteria in drinking water systems (Wolfe 1990 and 2001) suggest that the number of heterotrophic nitrifiers in drinking water systems may be negligible compared to autotrophic nitrifiers. In comparison, heterotrophic nitrification occurs in wastewater applications (Grady et al. 1980).

Chloramines are produced in a reaction between free chlorine and ammonia. Chloramination is commonly used for secondary disinfection purposes to control microbial growth in finished water. Chloramines include monochloramine, dichloramine, trichloramine, and organochloramines. For disinfection purposes, monochloramine is the preferential form.

Chloramine use is expected to increase in the near future as a result of more stringent disinfection by-product (DBP) maximum contaminant levels (MCLs) associated with the Stage I and Stage II Disinfectant/Disinfection By-Product Rule (DDBP Rule). Review of the Information Collection Rule (ICR) database indicates that 33% of 353 treatment plants use chloramines. The draft regulatory impact analysis prepared for the Stage 2 Microbial and

Disinfection Byproducts Federal Advisory Committee predicted that the use of chloramines could increase to as much as 65% of surface water systems (U.S. EPA M/DBP FACA Support Document, 2000). For non-ICR systems serving less than 10,000 people, it is estimated that approximately 50% of utilities will shift from free chlorine to chloramines to reduce DBP levels below the Stage I MCLs (U.S. EPA M/DBP FACA Support Document, 2000).

2.0 Description of Potential Water Quality Problems

Nitrification can have the adverse impacts of increasing nitrite and nitrate levels, reducing alkalinity, pH, dissolved oxygen, and chloramine residuals, and promoting bacterial regrowth (Wilczak et al. 1996). Table 1 provides a summary of water quality problems associated with nitrification.

Table 1 Summary of Water Quality Problems Associated with Nitrification	
Chemical Issues	Biological Issues
Disinfectant Depletion	HPC Increase
Nitrite/Nitrate Formation	Ammonia Oxidizing Bacteria (AOB) Increase
Dissolved Oxygen Depletion	Nitrite Oxidizing Bacteria (NOB) Increase
Reduction in pH and Alkalinity	
DBP Formation due to Mitigation Techniques	

Various potential health impacts have been associated with issues identified in Table 1. The Chemical Health Effects Tables (U.S. Environmental Protection Agency, 2002a) provides a summary of potential adverse health effects from high/long-term exposure to hazardous chemicals in drinking water. The Microbial Health Effects Tables (U.S. Environmental Protection Agency, 2002b) provides a summary of potential health effects from exposure to waterborne pathogens.

While nitrification can degrade water quality, the formation of nitrite/nitrate and DBP formation during nitrification mitigation are the only water quality issue identified in the literature with the potential to impact public health directly. Other issues listed in Table 1 either are already regulated under provisions of the Safe Drinking Water Act, or were not identified within existing literature as posing direct public health impacts. However, more research may be needed to better understand interactions between these issues.

For example, reductions in pH and alkalinity can be a symptom of nitrification, as shown by hydrogen ion formation in equations (1) and (2). Although reductions in pH and alkalinity may not pose a direct public health threat, such reductions could theoretically lead to a violation of the USEPA Lead and Copper Rule (1991) either through failure to maintain designated optimal water quality parameters, or possibly through an action level exceedence at the tap. In 1997, the City of Willmar, Minnesota conducted a study to determine the causes of copper corrosion within household plumbing systems. Preliminary indications were that both nitrification and copper corrosion proceeded simultaneously during water distribution, so that there might be some linkage between the two phenomena within specific households (Murphy et al., 1997). System-wide Lead and Copper Rule violations due to nitrification were not cited in the literature.

Disinfection depletion and HPC increases are other examples of water quality impacts associated with nitrification that are addressed under provisions of the Safe Drinking Water Act. The loss of disinfectant residual does not necessarily pose a direct public health threat (many systems throughout the world are operated without use of a disinfectant residual). However, disinfectant decay can contribute to microbiological problems such as growth of organisms within the bulk water or accumulated sediments. The Surface Water Treatment Rule establishes maximum contaminant level goals (MCLGs) for viruses, *Legionella*, HPC, and *Giardia lamblia*. It also includes treatment technique requirements for filtered and unfiltered systems that are specifically designed to protect against the adverse health effects of exposure to these microbial pathogens. The Surface Water Treatment Rule requires that a “detectable” disinfectant residual (or HPC measurements not exceeding 500/mL) be maintained in at least 95% of samples collected throughout the distribution system on a monthly basis. A system that fails to comply with this requirement for any two consecutive months is in violation of the treatment technique requirement. Public water systems that disinfect must monitor for the presence of a disinfectant residual (or HPC levels) at the same frequency and locations as total coliform measurements taken pursuant to the total coliform regulation.

Nitrite/Nitrate Formation

Under the Safe Drinking Water Act (SDWA), primary MCLs have been established for nitrite-N, nitrate-N, and the sum of nitrite-N plus nitrate-N. The MCLs are 1 mg/L for nitrite-N, 10 mg/L for nitrate-N, and 10 mg/L for nitrite + nitrate (as N). The current nitrite and nitrate standards are measured at the point of entry to the distribution system so any subsequent elevated nitrite/nitrate levels resulting from nitrification within the distribution system are not identified by compliance monitoring.

Nitrite and nitrate are produced during nitrification through ammonia utilization by nitrifying bacteria. According to equations (1) and (2), for every mole of ammonia-N produced, a 1-mole equivalent of nitrite-N is produced. Subsequently, for every mole of nitrite-N produced, a 1-mole equivalent of nitrate-N is produced.

Ammonia can also be released from chloramines through a series of complex reactions. Reactions 2 through 6 in Table 2 describe five mechanisms of ammonia release presented by Wooschlager et al. (2001). According to Valentine et al (1998), the overall net stoichiometries can be used to examine the relationship between chloramine decay and ammonia production. Review of the equations presented thus far indicates that the greatest fraction of ammonia species is produced from Reaction 3 in Table 2.

Table 2
Overview of Nitrification and Chloramine Reactions

Reaction Description	Overall Reaction
1. Ammonium and nitrite utilization	$\text{NH}_3 + \text{O}_2 \rightarrow \text{NO}_2^- + 3\text{H}^+ + 2\text{e}^-$ $\text{NO}_2^- + \text{H}_2\text{O} \rightarrow \text{NO}_3^- + 2\text{H}^+ + 2\text{e}^-$
2. Release of ammonia through chloramine decay (autodecomposition)	$3\text{NH}_2\text{Cl} \rightarrow \text{N}_2 + \text{NH}_3 + 3\text{Cl}^- + 3\text{H}^+$
3. Release of ammonium through oxidation of organic matter by chloramine	$1/10 \text{C}_5\text{H}_7\text{O}_2\text{N} + \text{NH}_2\text{Cl} + 9/10\text{H}_2\text{O} \rightarrow 4/10\text{CO}_2 + 1/10\text{HCO}_3^- + 11/10\text{NH}_4^+ + \text{Cl}^-$
4. Release of ammonium through reaction of chloramine with corrosion products at pipe surfaces*	$1/2\text{NH}_2\text{Cl} + \text{H}^+ + \text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + 1/2\text{NH}_4^+ + 1/2\text{Cl}^-$
5. Release of ammonia through catalysis reactions of chloramine at pipe surfaces	$3\text{NH}_2\text{Cl} \rightarrow \text{N}_2 + \text{NH}_3 + 3\text{Cl}^- + 3\text{H}^+$
6. Release of ammonia through oxidation of nitrite by chloramine*	$\text{NH}_2\text{Cl} + \text{NO}_2^- + \text{H}_2\text{O} \rightarrow \text{NH}_3 + \text{NO}_3^- + \text{HCl}$

Source: Adapted from Wooschlager et al. 2001

* These equations may not be significant in distribution systems, especially in situations of biologically-accelerated chloramine decay.

In this case, ammonium is released through oxidation of organic matter by chloramine. Greater than one mole of ammonium is produced (11/10 mole), all of which can be converted to nitrate, based on the molar ratios presented in Reaction 1. Many of these reactions can occur simultaneously; however, a conservative approach for predicting *maximum* nitrite/nitrate formation would be to use Reaction 3 in Table 2. Based on this approach, Table 3 was developed to assess the impact of Cl₂:NH₃-N ratio, total chloramine dose, and chloramine decay on theoretical nitrite/nitrate-N formation through nitrification.

Table 3
Theoretical Nitrite/Nitrate Production Based on Chloramine Decay Stoichiometry

Chlorine to Ammonia-N Ratio	Total Chlorine Dose (mg/L)	Ammonia-N Dose (mg/L)	Nitrite/Nitrate-N Produced* (mg/L)
5:1	4	0.8	0.9
4:1	4	1.0	1.1
3:1	4	1.3	1.5
5:1	3	0.6	0.7
4:1	3	0.8	0.8
3:1	3	1.0	1.1
5:1	2	0.4	0.4
4:1	2	0.5	0.6
3:1	2	0.7	0.7
5:1	1	0.2	0.2
4:1	1	0.3	0.3
3:1	1	0.3	0.4

* Assumes: (1) 100% of chloramine decay according to reaction: $1/10 \text{C}_5\text{H}_7\text{O}_2\text{N} + \text{NH}_2\text{Cl} + 9/10\text{H}_2\text{O} \rightarrow 4/10\text{CO}_2 + 1/10\text{HCO}_3^- + 11/10\text{NH}_4^+ + \text{Cl}^-$, (2) 100% conversion of ammonia to nitrite/nitrate.

The results in Table 3 show that using the most conservative chloramine decay reaction, the nitrite-N MCL of 1 mg/L could theoretically be exceeded if the chloramine dose is at 3 or 4 mg/L (as total chlorine), and the $\text{Cl}_2:\text{NH}_3\text{-N}$ ratio is less than 5:1. As the chlorine to ammonia-N ratio decreases, more ammonia becomes available for the nitrification process. This calculation is quite conservative as it is unlikely that 100% of chloramine decay will occur according to one single pathway.

Valentine et al (1998) conducted a series of mass and redox balances on solutions of varying pH, NOM concentration, and initial chloramine concentration. For all conditions that were studied, the amount of nitrate formed as a percentage of monochloramine decay was less than 15 percent, and for all but three cases the amount was less than 10 percent. The authors concluded that although nitrate is an important decomposition product of monochloramine decay, it is not the major nitrogen-containing decay species.

Using data from a survey of 40 utilities that use chloramine as a disinfectant and an earlier survey by Hack (1984), Wilczak et al. (1996) indicate that nitrite and nitrate levels may increase on the order of 0.005 to 0.5 mg/L, although increases of greater than 1 mg/L are possible. The authors concluded that changes in nitrite and nitrate levels in drinking water usually caused by nitrification are not substantial enough to exceed regulatory requirements as long as source related levels are not near the regulatory MCLs. Nitrite levels during nitrification episodes have been reported ranging from 0.005 to 0.5 mg/L as $\text{NO}_2^- \text{-N}$, with levels more frequently ranging from 0.015 to 0.1 mg/L (Wolfe et al. 2001). Figure 1 compares treatment plant effluent and distribution system nitrite concentrations in nine chloraminating utilities (Kirmeyer et al. 1995). This figure demonstrates that nitrite levels during nitrification events can vary from as little as 0.05 mg/L to as much as 1 mg/L.

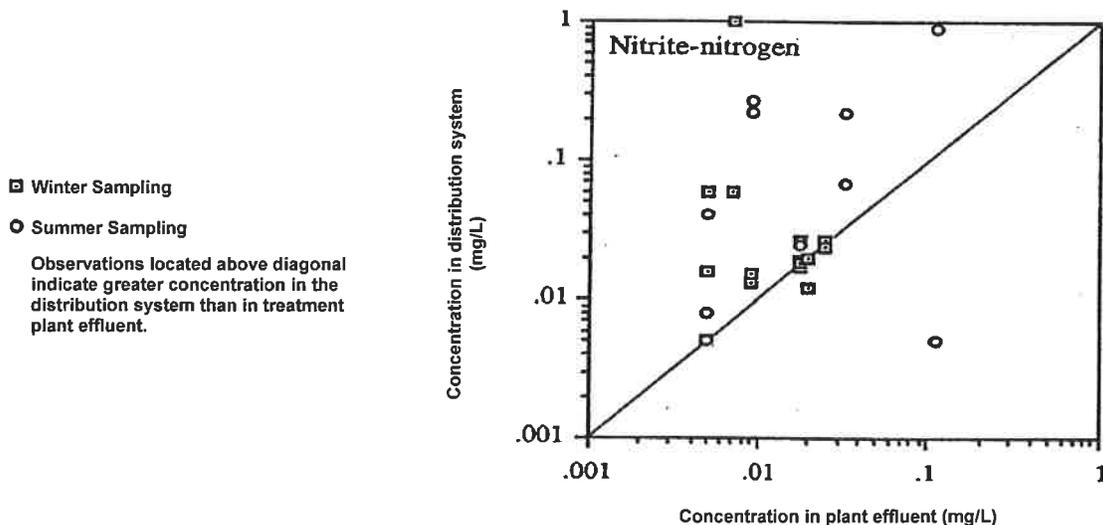


Figure 1
Comparison Between Plant Effluent and Distribution System Concentrations of Nitrite
 Source: Kirmeyer et al. 1995

3.0 Prevention/Mitigation Methods

Both groups of nitrifying bacteria are obligate aerobic organisms commonly found in terrestrial and aquatic environments (Holt et al. 1995, Watson et al. 1981). Their growth rates are controlled by:

- Substrate (ammonia-N) concentration,
- Temperature,
- pH,
- Light,
- Oxygen concentration, and
- Microbial community composition.

Water quality and environmental factors affecting nitrification are discussed below.

3.1 Source Water Treatment

3.1.1 Sources of Ammonia, Nitrate, and Nitrite

Excess nitrogen in the form of ammonia in finished water can be the principal cause of nitrification since ammonia serves as the primary substrate in the nitrification process. Ammonia, nitrate and nitrite can typically be found in surface water supplies as a result of natural processes. These natural sources of nitrogen generally have minimal impacts on water supply distribution systems because the concentration of nitrite nitrogen in surface and ground waters is normally far below 0.1 mg/L (Sawyer and McCarty, 1978). Other sources of nitrogen can include agricultural runoff from fertilization or livestock wastes or contamination from sewage. Ammonia also occurs naturally in some groundwater supplies, and groundwater can become contaminated with nitrogen as agriculture runoff percolates into aquifers. A survey of 67 large utilities (greater than 50,000 customers) found that average levels of raw water nitrate ranged from 0 to 5.7 mg/L (Kirmeyer et al. 1995). To protect public health, any system with source water that exceeds the inorganic contaminant MCLs for nitrate and nitrite of 10 mg/L and 1 mg/L (as Nitrogen), respectively, must treat the water to below those levels (USEPA 2001). However, if a water treatment plant removes nitrate and nitrite levels to just meet the MCLs, and the water system uses chloramine for disinfection, there is a potential for nitrate and nitrite values during a nitrification event to exceed the numeric values of their respective MCLs.

Ammonia is deliberately added to a chloraminated water supply. In these systems, the concentration of free ammonia present in the distributed water will be a function of the chlorine to ammonia-N ($\text{Cl}_2:\text{NH}_3\text{-N}$) ratio. Free ammonia is almost completely eliminated when a 5:1 weight ratio of $\text{Cl}_2:\text{NH}_3\text{-N}$ is used (Kirmeyer et al. 1993). Nitrate/nitrite-N formation results presented previously in Table 3 showed that the lowest amount of nitrate/nitrite-N is formed when a 5:1 ratio is used.

3.1.2 Removal of Natural Organic Matter (NOM)

Song (1999) documented the impact of NOM on chloramine decay by altering NOM concentrations through GAC adsorption of the test water. Figure 2 shows the impact of NOM on chloramine decay rates.

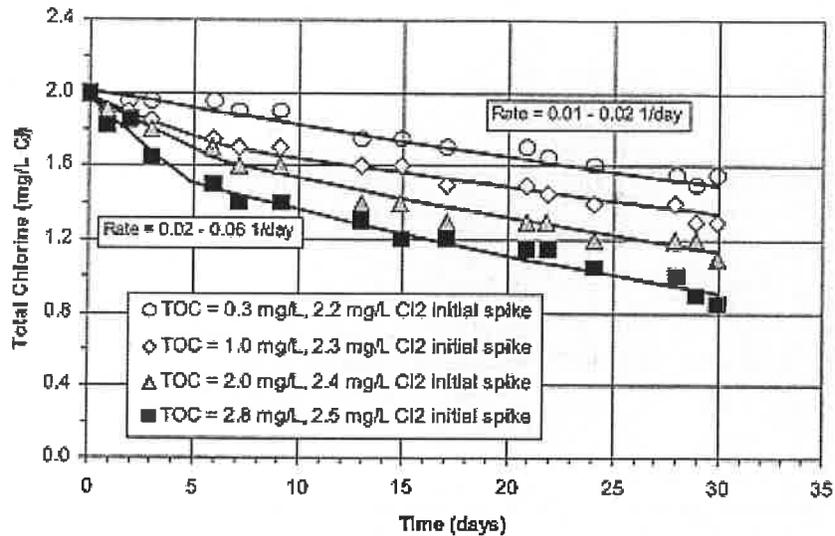


Figure 2
Elimination of Chloramine-NOM Reaction by TOC Removal with GAC Adsorption in USL WTP
Filtered Water at pH = 8.5
Source: Song 1999.

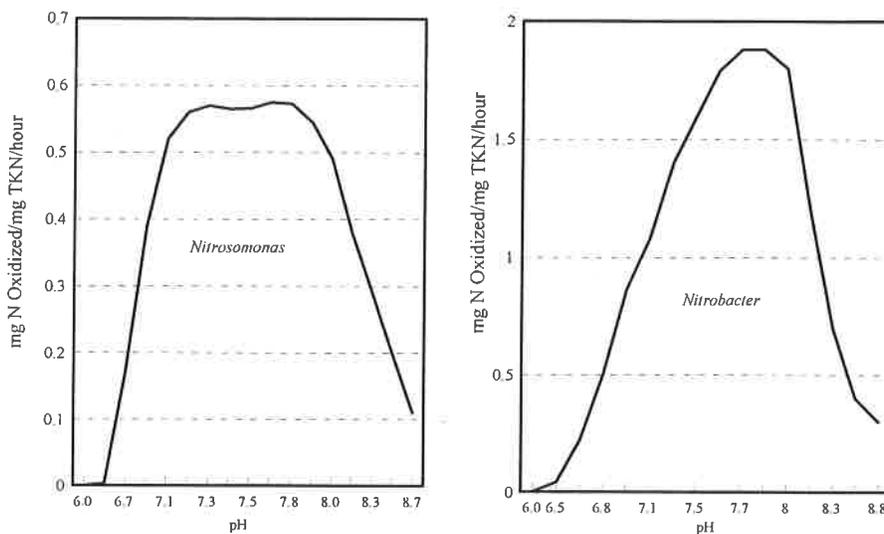
For the lowest TOC condition, only the autodecomposition pathway occurred. Bone et al (1999) hypothesized that the NOM oxidation mechanism is the dominant pathway for chloramine decay early in the decay process (i.e., within 24 hours), and that autodecomposition is the dominant cause of chloramine decay later.

3.1.3 pH and Alkalinity

Bulk water pH value is an important factor in nitrification activity for two reasons. First, a reduction of total alkalinity may accompany nitrification because a significant amount of bicarbonate is consumed in the conversion of ammonia to nitrite. A model developed by Gujer and Jenkins (1974) indicates that 8.64 mg/L of bicarbonate (HCO_3^-) will be utilized for each mg/L of ammonia-nitrogen oxidized. While reduction in alkalinity does not impose a direct public health impact, reductions in alkalinity can cause reductions in buffering capacity, which can impact pH stability and corrosivity of the water toward lead and copper. The relationships between pH, alkalinity, corrosivity, and metals leaching are addressed in a separate White Paper.

Secondly, nitrifying bacteria are very sensitive to pH as shown in Figure 3. *Nitrosomonas* has an optimal pH between approximately 7.0 and 8.0, and the optimum pH range for *Nitrobacter* is approximately 7.5 to 8.0. Some utilities have reported that an increase in pH (to greater than 9)

can be used to reduce the occurrence of nitrification (Skadsen et al. 1996). However, many other factors contribute to the viability of nitrifying bacteria and as a result, nitrification episodes have been observed at pH levels ranging from 6.6 to 9.7 (Odell et al. 1996).



Source: Grady and Lim 1980

Figure 3
Effects of pH on *Nitrosomonas* and *Nitrobacter* enrichment cultures

According to Wilczak (2001) pH appears to be the most important factor controlling the rate of chloramine autodecomposition. Thomas (1987) stated that the rate of chloramine decay approximately doubles for a drop in pH of 0.7 units.

3.1.4 Disinfection Practices

Chemical control or treatment of nitrifying bacteria typically involves either the maintenance of high distribution system disinfectant residuals (greater than 2 mg/L) or periodic breakpoint chlorination. Analytical survey results of ten U.S. utilities showed that greater than 90% of distribution system samples with increased nitrite and nitrate levels, indicative of nitrification, occurred in water with disinfectant residuals less than 2 mg/L (Wilczak et al. 1996). Many utilities have found that increasing disinfectant residuals by increasing chemical doses or managing water age has helped to control nitrification.

Utilities can use booster chlorination in the distribution system to increase disinfectant residuals. This practice is generally not employed in chloraminated distribution systems because chloramines are normally more stable than free chlorine (Woolschlager et al. 2001, Valentine et al. 1998). In addition, uncontrolled blending of chlorinated and chloraminated water could occur near a chlorine booster station; in some cases uncontrolled blending has been shown to cause unintended breakpoint chlorination, increases in DBP levels, or decreases in disinfectant residuals (Mahmood et al. 1999 and Muylwyk et al. 1999). In 2001, one utility installed a chloramine booster station that adds both sodium hypochlorite and aqueous ammonia to increase residuals in a remote area of a distribution system (Potts et al. 2001). The booster station was

designed to carefully control the chlorine to ammonia ratio and avoid excess ammonia in the downstream system. The effects of the booster station on nitrification have not yet been fully assessed (Potts et al. 2001).

Free chlorine is more effective at inactivating ammonia-oxidizing bacteria colonies than chloramines (Wolfe et al. 1990). As a result, breakpoint chlorination is also used by utilities to treat nitrifying bacteria. According to Schrempp et al. (1994), mechanically cleaning pipelines; draining and cleaning reservoirs; and dead-end, unidirectional and continuous flushing; were not sufficient to control nitrification at one mid-western utility. When these strategies were replaced with breakpoint chlorination, nitrification was controlled and target residuals could be maintained. Some systems using breakpoint chlorination have reported an initial increase in HPC bacteria and total coliform levels immediately following treatment that is probably attributable to biofilm sloughing (Odell et al. 1996, Wilczak et al. 1996).

3.2 Absence of Sunlight

Although monochloramine will degrade when exposed to the atmosphere at varying rates depending on the amount of sunlight, wind, and temperature (Wilczak, 2001), nitrifiers are very sensitive to near UV, visual, and fluorescent light; consequently, nitrification episodes in distribution systems occur in the dark (in covered reservoirs, pipelines, taps, etc.) (Wolfe et al, 2001). Wolfe et al (2001) also report that nitrifiers do have an excision repair mechanism for DNA repair; therefore low levels of nitrifiers may be recovered from partially shaded reservoirs or channels.

The Long-Term 2 Enhanced Surface Water Treatment Rule will require utilities to either cover uncovered finish water reservoirs or treat reservoir discharge to the distribution system to achieve a 4-log virus inactivation, unless the State/Primacy Agency determines that existing risk mitigation is adequate. The potential increase in nitrification episodes associated with covering uncovered storage facilities within chloraminated systems was not addressed within the literature.

3.3 Operations Activities

Nitrifying bacteria are slow growing organisms, and nitrification problems usually occur in large reservoirs or low-flow sections of the distribution system. According to Kirmeyer et al (1995), operational practices that ensure short residence time and circulation within the distribution system can minimize nitrification problems. Low circulation areas of the distribution system such as dead-ends and reservoirs are prime areas for nitrification occurrence since detention time and sediment buildup can be much greater than in other parts of the system.

Water temperature has a strong effect on the growth rate of nitrifying bacteria. Numerous researchers have documented that nitrification episodes are more common during the warmer months. Most strains of nitrifiers grow optimally at temperatures between 25 and 30°C (Watson, Valos, and Waterbury, 1981) but nitrification has occurred over a wide range of temperatures (8-26°C) (Kirmeyer et al. 1995). Operations activities that lead to decreased water age may also result in decreased bulk water temperatures.

The blending of distribution system waters containing different disinfectants may also have an impact on nitrification. Typically, the blended $\text{Cl}_2:\text{NH}_3\text{-N}$ ratio will increase after blending. Most often this is due to dilution of the ammonia fraction in the chloraminated water. The impact on the blended total chlorine residual will be a function of the initial chlorine and chloramine residuals.

A few studies have assessed the feasibility of blending chloraminated and chlorinated water in distribution systems (Mahmood et al. 1999; Muylwyk et al. 1999; and Barrett et al. 1985). Documented problems related to blending chlorinated and chloraminated water include the loss of disinfectant residuals, increases in tastes and odors, and increases in disinfection by-products, all of which are related to uncontrolled breakpoint chlorination that occurs in disinfectant blending zones (Barrett et al. 1985; and Mahmood et al. 1999). However, a few utilities do successfully blend their own chlorinated supplies with purchased chloraminated water. This is primarily accomplished when the chloraminated supply has excess ammonia that, when blended with the chlorinated supply, serves to form chloramines (Wolfe et al. 1988). In those cases, the blending ratios, and chlorine to ammonia ratios are strictly controlled to prevent breakpoint chlorination (Barrett et al. 1985).

A new AwwaRF Report which updates the 1993 report *Optimizing Chloramine Treatment* (Kirmeyer et al. 1993) includes an international survey of chloraminating utilities and is expected to provide additional information on blending multiple disinfectants.

3.4 Monitoring

The EPA Phase II Inorganic Contaminant regulations require water systems to sample for nitrite and nitrate at each entry point to the distribution system on at least an annual basis. Additional monitoring is required on a quarterly basis for at least one year following any one routine sample in which the measured concentration is greater than 50 percent of the MCL (EPA 2001). The MCLs are 1 mg/L for nitrite-N, 10 mg/L for nitrate-N, and 10 mg/L for nitrite + nitrate (as N).

Monitoring distribution system water quality can help to predict the on-set of a nitrification event. According to Wilczak et al, (1996), nitrification is often indirectly identified by one or more symptoms including:

- Loss of chloramine residual,
- Increase in water temperature,
- Decrease in dissolved oxygen,
- Drop in pH and alkalinity, and
- Increase in HPC population.

Individual utilities use combinations of the indicators listed based on their system's experience managing nitrification to initiate nitrification control measures. Example criteria reported in the literature as triggers for breakpoint chlorination include nitrite action levels of 0.05 mg/L and falling chloramine residuals (Odell et al. 1996, Wilczak et al. 1996, Wolfe 1988).

Nitrification occurrence can be confirmed by monitoring for nitrite or nitrate. Wilczak et al (1996) suggest that an accurate nitrogen balance and specific biological monitoring for ammonia-oxidizing bacteria and nitrite-oxidizing bacteria are the best ways to determine whether nitrification is occurring.

4.0 Summary

Nitrification is a microbial process by which reduced nitrogen compounds (primarily ammonia) are sequentially oxidized to nitrite and nitrate. Ammonia is present in drinking water through either naturally-occurring processes or through ammonia addition during secondary disinfection to form chloramines. Chloramine use is expected to increase in the near future as a result of more stringent disinfection by-product (DBP) maximum contaminant levels (MCLs) associated with the Stage I and Stage II Disinfectant/Disinfection By-Product Rule (D/DBP Rule). There are several symptoms of nitrification that can impact distribution system water quality. Of the water quality issues identified in the literature and summarized in Table 1, only the formation of nitrite and nitrate within the distribution system poses a potential direct public health threat, and is not addressed through current provisions of the Safe Drinking Water Act. The findings of this paper suggest that a nitrite or nitrate MCL violation with the distribution system is unlikely, unless treated water nitrite and nitrate levels are near their respective MCLs. Additional research may be warranted to determine if nitrification episodes can cause direct violations of the Lead and Copper Rule. The causes of nitrification and prevention and mitigation approaches have been thoroughly documented within the literature.

5.0 Secondary Considerations

5.1 Increased Disinfection By-Products during Mitigation

Nitrification mitigation techniques such as break-point chlorination or temporarily switching from chloramines to free chlorine can result in increased levels of disinfection by-products. Disinfection by-products are regulated under the Stage 1 Disinfectants and Disinfection By-Product Rule. Under the Disinfectants and Disinfection By-Product Rule compliance monitoring samples are collected under routine operating conditions. Thus, disinfection by-product samples collected during a nitrification mitigation episode are not typically included in MCL compliance calculations. It would also be possible to exceed a Maximum Residual Disinfectant Level (MRDL) under the Disinfection By-Product Rule during a nitrification mitigation episode. However, the USEPA specifically allows short-term exceedence of MRDLs to control microbiological contamination problems.

5.2 Source Water Nitrification

Under certain circumstances nitrification can have a beneficial impact on drinking water quality. This would be true in the controlled conditions at a water treatment plant. Rittmann and Snoeyink (1984) reported that nitrification of ammonia-containing groundwater resulted in "biologically stable" water that did not permit bacterial growth in the distribution system. Kurtz-Crooks et al. (1986) showed that the chlorine demand of ammonia-laden groundwater was

reduced after nitrification. Nitrification was found to lower treatment costs and reduce formation of trihalomethanes.

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APPENDIX C: MOISTURE REPORT



February 10, 2014

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Prime Coatings Inc.
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Mr. Kavous Emami
KEC Engineers, Inc.
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RE: Concrete Dryness Testing, Greystone Reservoir, 1061 Dam, Beverly Hills, CA 90210.

Gentlemen,

Thank you for inviting us to measure concrete dryness at your Greystone Reservoir project. The purpose for performing this survey was to quantify concrete moisture content and help determine the suitability of the concrete slabs for the installation of a water resistant coating. In our opinion the use of concrete in-situ relative humidity tests offers the best method judging concrete dryness by measuring moisture inside of a concrete slab. The attached spreadsheet shows the results of concrete in-situ relative humidity testing performed at the above referenced facility. Additionally, we measured electrical impedance with a Tramex™ Concrete Moisture Encounter and performed pH testing on the exposed substrate. A total of ten (10) test sites were created for this survey. This is a water reservoir interior project and the concrete slab has never hosted any type of coating.

The use of in-situ relative humidity measurements to determine dryness of a concrete slab is relatively new to the United States marketplace. The test method has been used extensively in Europe and is now gaining favor in the United States. In 2002, the American Society for Testing and Materials (ASTM) committee F.06 on Resilient Flooring proposed a standard for the use of this test method. The standard has been adopted, published and is known by its numerical assignment ASTM F 2170-11. The test measures moisture inside of a concrete slab and reports it as a percentage of relative humidity. ASTM F 710-11 Standard Practice for Preparing Concrete Floors to Receive Resilient Floorcovering states that concrete in-situ relative humidity should be 75% or less (unless otherwise noted by a floor covering or coating manufacturer) when tested in accordance with ASTM F2170.

In-situ relative humidity values are shown in the center of the attached spreadsheet. Concrete surface pH test results are seen in the third column of the spreadsheet. A pH of 7.0 is considered neutral, with lower values being acidic and higher values being alkaline. Concrete by its nature is alkaline, a characteristic that helps prevent reinforcing steel from rusting. Manufacturers of adhesives and resinous coatings publish a range of surface pH levels, which allow the installation and curing of their products. Please compare our test results with published guidelines. Typical maximum pH acceptable for modern adhesives and resinous coatings ranges from pH 9 to pH10. Tramex™ electrical impedance readings are to the right of the pH test results. This test method is accepted by certain floor covering and coating material manufacturers and is included for that purpose. The manufacturers that accept this type of testing typically require maximum concrete moisture content of 4.5% or less.

In-situ relative humidity test sites are created by drilling 3/4" diameter holes into the concrete slab. The depth of the holes should equal 40% of the concrete slab's thickness. In this case the slabs are below-grade concrete with an unknown thickness. The test holes were drilled to a depth of 1.5-inches in order to satisfy the Prime Coatings Inc. requirements. Wagner™ brand probes were inserted into the test holes which were then capped. The test holes, or wells, and probes were allowed to equilibrate for approximately 72 hours prior to taking in-situ relative humidity measurements.

Testing performed in this survey utilized a Wagner Reader and Wagner Rapid RH™ relative humidity probes.

ASTM F-2170 requires that "Concrete floor slabs shall be at service temperature and the occupied air space above the floor slab shall be at service temperature and service relative humidity for at least 48 hours before making relative humidity measurements in the concrete slab." The subject facility is not intended to be occupied space and a HVAC system is not in place. A Dickson™ data logger was placed on-site during the test period to monitor ambient temperature and relative humidity levels for documentation purposes. On our return to read the probes our data logger was not located at the site placed, nor found within the facility. The ambient environmental conditions were sampled and recorded during probe reading, which indicate extremely high ambient relative humidity.

A plan showing test sites as yellow dots for floor placements and green dots for wall placements is attached and numbered to correspond with the test data spreadsheet. We did not undertake testing or investigation of the concrete's quality or thickness.

To encapsulate the spreadsheet data:

1. All ten (10) concrete in-situ relative humidity readings in the concrete slab exceeded 75% ranging between Hi%, which exceeds ability for Wager Rapid RH probes to report, and 99%.

2. Tramex meter readings ranged between 5.5% and 6%. The coarseness of the concrete surfaces may affect readings with this instrument.
3. Concrete floor slab's surface pH ranged between pH 6.5 and pH 9. Readings were not obtainable on the wall surfaces.

Concrete moisture content in the slab exceeds maximum permissible levels for most coating systems. It is noteworthy, concrete moisture content will never fall below ambient relative humidity and at the time of our readings there was near equilibrium.

It is our understanding that dehumidifiers are to be placed on-site and we are to re-read the probes on Monday, February 17, 2013.

The information and contained herein are based on the testing performed and comparison to similar investigations. Please feel free to call with any questions or if we can be of further assistance. Thank you for the continued opportunity to be of service.

Sincerely,



George Donnelly
Principal

GEORGE DONNELLY TESTING AND INSPECTIONS
 #1 Curso Lane, Hot Springs Village, AR 71909 Phone 501-915-0626, Fax 501-915-9251
 Greystone Reservoir
 Test Location: 1061 Dam, Beverly Hills, CA 90210 Dates: 02/03 - 06/2014

**Concrete Slab
 In-situ Relative Humidity Testing**

Test #	Test Site	pH	Tramex		Ambient		1.5" Below Surface		Special Notes		Comments
			na	5	RH	Temp	RH	Temp	Probe#	Notes	
1	See Site Plan	na		5	95.3%	65.4°	99.0%	66.0°	Wagner	Wall	Open Concrete
2	See Site Plan	na		5.5	96.4%	66.0°	99.0%	66.0°	Wagner	Wall	Open Concrete
3	See Site Plan	6.5		5	96.1%	65.7°	99.0%	66.0°	Wagner		Open Concrete
4	See Site Plan	6.5		6	97.9%	65.0°	98.0%	66.0°	Wagner		Open Concrete
5	See Site Plan	6.5		5	95.8%	65.8°	98.0%	66.0°	Wagner		Open Concrete
6	See Site Plan	9		5	96.0%	66.0°	Hi	66.0°	Wagner		Open Concrete
7	See Site Plan	6.5		5	96.1%	66.1°	98.0%	66.0°	Wagner		Open Concrete
8	See Site Plan	9		6	98.1%	65.9°	99.0%	66.0°	Wagner		Open Concrete
9	See Site Plan	6.5		5	97.9%	66.2°	97.0%	66.0°	Wagner		Open Concrete
10	See Site Plan	9		5	98.0%	66.4°	Hi	66.0°	Wagner		Open Concrete

Concrete In-situ Relative Humidity Tests performed to ASTM F 2170-11 standards utilizing Wagner brand test equipment.

GEORGE DONNELLY TESTING AND INSPECTIONS
#1 Curso Lane, Hot Springs Village, AR 71909 **Phone 501-915-0626, Fax 501-915-9251**

Greystone Reservoir

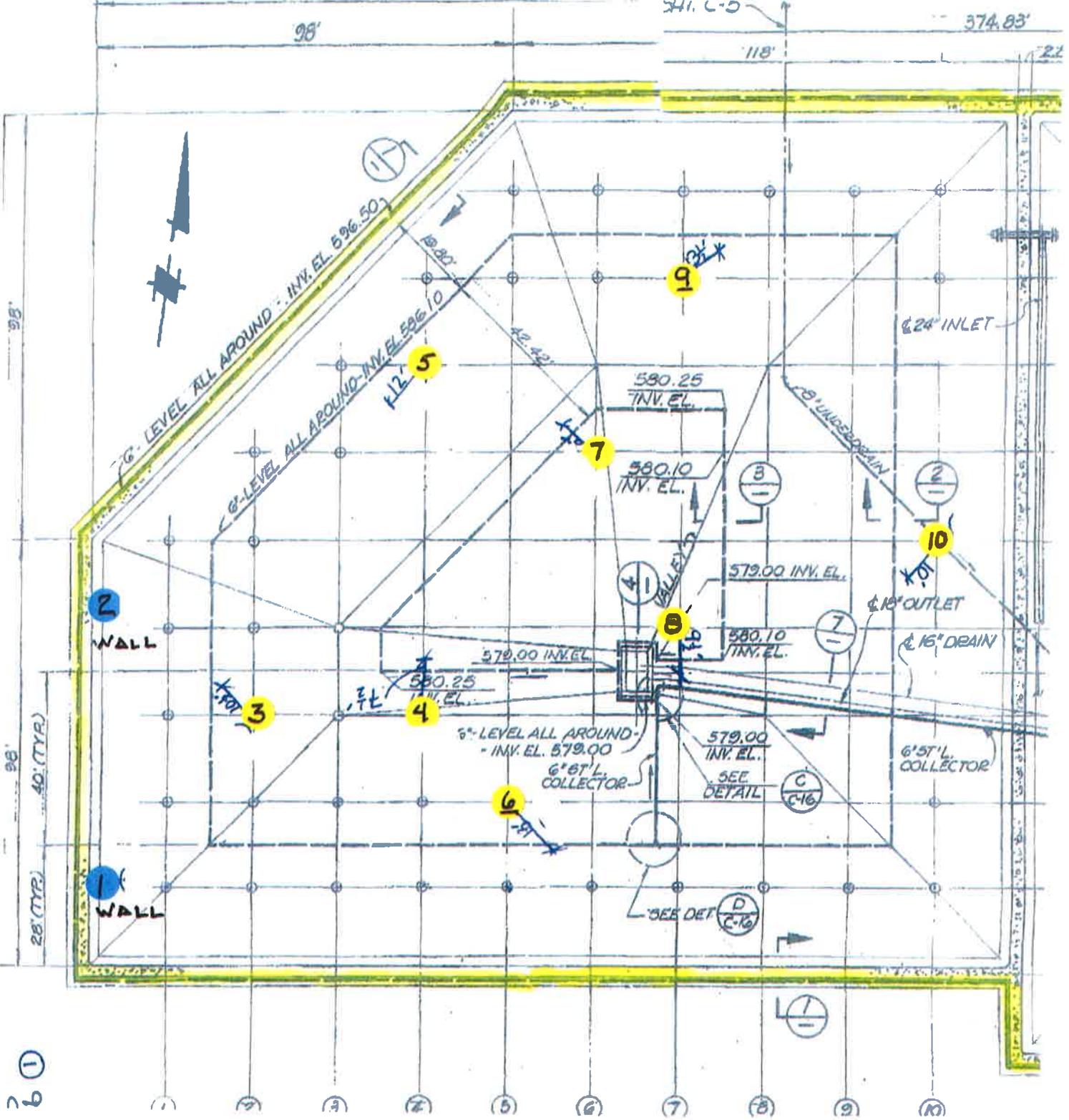
Test Location: 1061 Dam, Beverly Hills, CA 90210

Dates: 02/03 - 06/2014 Re-read 02/24/2014

**Concrete Slab
 In-situ Relative Humidity Testing**

Test #	Test Site	2/24/2014			2/6/2014		2/24/2014		Comments	
		pH	Tramex	Ambient		1.5" Below Surface		1.5" Below Surface		
				RH	Temp	RH	Temp	RH		Temp
1	See Site Plan	na	5	Data	Logger	99.0%	66.0°	98.0%	67.0°	Open Concrete Wall
2	See Site Plan	na	5	Data	Logger	99.0%	66.0°	99.0%	67.0°	Open Concrete Wall
3	See Site Plan	6.5	4.5	Data	Logger	99.0%	66.0°	99.0%	67.0°	Open Concrete Floor
4	See Site Plan	6.5	6	Data	Logger	98.0%	66.0°	98.0%	67.0°	Open Concrete Floor
5	See Site Plan	6.5	4.5	Data	Logger	98.0%	66.0°	98.0%	68.0°	Open Concrete Floor
6	See Site Plan	9	5	Data	Logger	Hi	66.0°	Hi	68.0°	Open Concrete Floor
7	See Site Plan	6.5	5	Data	Logger	98.0%	66.0°	97.0%	68.0°	Open Concrete Floor
8	See Site Plan	9	5	Data	Logger	99.0%	66.0°	99.0%	66.0°	Open Concrete Floor
9	See Site Plan	6.5	5	Data	Logger	97.0%	66.0°	97.0%	68.0°	Open Concrete Floor
10	See Site Plan	9	5	Data	Logger	Hi	66.0°	Hi	67.0°	Open Concrete Floor
				(See attached Data Logger Sheet)						

Concrete In-situ Relative Humidity Tests performed to ASTM F 2170-11 standards utilizing Wagner Rapid RH brand test equipment.



6 ①

98'

98'

28' (TYP.)
40' (TYP.)

98'

41. C-5

374.83'

118'

22'

6" LEVEL ALL AROUND - INV. EL. 596.50
6" LEVEL ALL AROUND - INV. EL. 596.10

580.25
INV. EL.

580.10
INV. EL.

579.00 INV. EL.

580.10
INV. EL.

579.00 INV. EL.

6" LEVEL ALL AROUND - INV. EL. 579.00

579.00
INV. EL.

6" 6" L. COLLECTOR

6" 5" L. COLLECTOR

SEE DET (D) C-16

24" INLET

16" OUTLET

16" DRAIN

WALL

WALL



① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩



7

9

5

2

3

4

6

8

3

2

10

7

C
C-16

D
C-16

6 ①

APPENDIX D: DATA SHEETS AND MSDS

Sikaflex[®]-2c NS EZ Mix

Two-component, non-sag, polyurethane elastomeric sealant

Description	Sikaflex-2c NS EZ Mix is a 2-component, premium-grade, polyurethane-based, elastomeric sealant. It is principally a chemical cure in a <u>non-sag</u> consistency. Meets ASTM C-920, Type M, Grade NS, Class 25, use T, NT, M, G, A, O and Federal Specification TT-S-00227E, Type II, Class A. Meets CAN/CGSB 19.24 - M90.
Where to Use	<ul style="list-style-type: none"> ■ Intended for use in all properly designed working joints with a minimum depth of ¼ inch. ■ Ideal for vertical and horizontal applications. ■ Placeable at temperatures as low as 40F. ■ Adheres to most substrates commonly found in construction. ■ An effective sealant for use in Exterior Insulation Finish Systems (EIFS). ■ Submerged environments, such as canal and reservoir joints.
Advantages	<ul style="list-style-type: none"> ■ Capable of ±50% joint movement. ■ Chemical cure allows the sealant to be placed in joints exceeding ½ in. in depth. ■ High elasticity with a tough, durable, flexible consistency. ■ Exceptional cut and tear resistance. ■ Exceptional adhesion to most substrates without priming. ■ Available in 35 architectural colors. ■ Color uniformity assured via Color-pak system. ■ Available in pre-pigmented Limestone Gray (no Color-pak needed). ■ Non-sag even in wide joints. ■ Certified to the NSF/ANSI Standard 61 for potable water. ■ Easy to mix. ■ Paintable with water-, oil-, and rubber-base paints. ■ Jet fuel resistant. ■ Cold weather booster for initial tack (see reverse side for data). ■ Shore A hardness can be increased by using "TG" additive. See Sikaflex-2c NS TG data sheet for specific details.
Coverage	1 gal. yields 231 cu. in. or 154 lin. ft. of a 1/2 in. x 1/4 in. joint.
Packaging	1.5 gal. unit, 3 gal unit. Color-pak is purchased separately. Limestone Gray color available pre-pigmented.
How to Use	
Surface Preparation	All joint-wall surfaces must be clean, sound, and frost-free. Joint walls must be free of oils, grease, curing compound residues, and any other foreign matter that might prevent bond. Ideally this should be accomplished by mechanical means. A roughened surface will also enhance bond. Bond breaker tape or backer rod must be used in bottom of joint to prevent bond.

Typical Data (Material and curing conditions 73°F (23°C) and 50% R.H.)

RESULTS MAY DIFFER BASED UPON STATISTICAL VARIATIONS DEPENDING UPON MIXING METHODS AND EQUIPMENT, TEMPERATURE, APPLICATION METHODS, TEST METHODS, ACTUAL SITE CONDITIONS AND CURING CONDITIONS.

Shelf life	One year in original, unopened containers.	
Storage Conditions	Store dry at 40°-95°F (4°-35°C). Condition material to 65°-75°F before using.	
Colors	A wide range of architectural colors are available. Special colors available on request.	
Application Temperature	40° to 100°F, ambient and substrate temperatures. Sealant should be installed when joint is at mid-range of its anticipated movement.	
Service Range	-40° to 170°F (-40°-75°C).	
Curing Rate (ASTM C-679)	Tack-Free Time	8-10 hrs.
	Final Cure	3 days
Application Life	4-6 hrs.	
Tear Strength	ASTM D-624	45 lb./in.
Shore A Hardness	ASTM D-2240	25 ± 5
Tensile Properties (ASTM D-412)		
	Tensile Strength at Break	95 psi
	Tensile Elongation	300%
	100% Modulus	70 psi
Adhesion in Peel (Fed Spec. TT-S-00227E)		
	Substrate	Peel Strength
	Concrete	>15 lb.
		% Adhesion Loss
		Zero
Weathering Resistance	Excellent	
Chemical Resistance	Good resistance to water, diluted acids, diluted alkalines, and residential sewage. Consult Technical Service for specific data.	



Priming	<p>Priming is typically not necessary. Most substrates only require priming if sealant will be subjected to water immersion after cure. Testing should be done, however, on questionable substrates, to determine if priming is needed.</p> <p>Consult Technical Service or Sikaflex Primer Technical Data Sheet for additional information on priming.</p> <p>Note: Most Exterior Insulation Finish Systems (EIFS) manufacturers recommend the use of a primer. When EIFS manufacturer specifies a primer or if on-site bond testing indicates a primer is necessary, Sikaflex 429 primer is recommended. On-site adhesion testing is recommended with final system prior to the start of a job.</p>
Mixing	<p>Pour entire contents of Component 'B' into pail of Component 'A'. Add entire contents of Color-pak into pail and mix with a low-speed drill (400-600 rpm) and Sikaflex paddle.* Mix for 3-5 minutes to achieve a uniform color and consistency. Scrape down sides of pail periodically. Avoid entrapment of air during mixing.</p> <p>When mixing in cold weather (<50°F), do not force the mixing paddle to the bottom of the pail. After adding Component 'B' and Color-pak into Component 'A', mix the top 1/2 to 3/4 of the pail during the first minute of mixing. After scraping down the sides of the pail, mix again for another minute. The paddle should reach the bottom of the pail between the first and second minute of mixing. Scrape down the sides of the pail a second time and then mix for an additional 2-3 minutes until the sealant is well blended.</p> <p>Color-pak must be used with tint base. For pre-pigmented Limestone base, just mix with low speed drill and Sikaflex paddle (no Color-pak needed).</p>
Application	<p>Recommended application temperatures 40°-100°F. Pre-conditioning units to approximately 70°F is necessary when working at extremes. Move pre-conditioned units to work areas just prior to application.</p> <p>Apply sealant only to clean, sound, dry, and frost-free substrates. Sikaflex-2c should be applied into joints when joint slot is at mid-point of its designed expansion and contraction.</p> <p>To place, load directly into bulk gun or use a follower plate loading system. Place nozzle of gun into bottom of joint and fill entire joint. Keeping the nozzle deep in the sealant, continue with a steady flow of sealant preceding nozzle to avoid air entrapment. Also, avoid overlapping of sealant since this also entraps air. Tool sealant to ensure full contact with joint walls and remove air entrapment. Joint dimension should allow for 1/4 inch minimum and 1/2 inch maximum thickness for sealant. Proper design is 2:1 width to depth ratio. To accelerate the cure of Sikaflex-2c NS in cold weather temperatures, add Sikaflex-2c booster.</p>
Limitations	<ul style="list-style-type: none"> ■ The ultimate performance of Sikaflex-2c NS EZ Mix, depends on good joint design and proper application. ■ Minimum depth in working joint is 1/4 in. ■ Maximum expansion and contraction should not exceed 50% of average joint width. ■ Do not cure in the presence of curing silicones. ■ Avoid contact with alcohol and other solvent cleaners during cure. ■ Allow 3-day cure before subjecting sealant to total water immersion. ■ Avoid exposure to high levels of chlorine. (Maximum level is 5 ppm). ■ Do not apply when moisture vapor transmission exists since this can cause bubbling within the sealant. ■ Avoid over-mixing sealant. ■ White color tends to yellow slightly when exposed to ultraviolet rays. ■ Light colors can yellow if exposed to direct gas fired heating elements. ■ When overcoating, an on-site test is recommended to determine actual compatibility. ■ Do not use in contact with bituminous/asphaltic materials.
Caution	<p>Component 'A'; Irritant - Avoid contact. Product is a skin, respiratory and eye irritant. Use of safety goggles and chemical resistant gloves recommended. Use of a NIOSH approved respirator required if PELs are exceeded. Use with adequate ventilation.</p> <p>Component 'B'; Combustible; Sensitizer; Irritant - Contains Xylene. Keep away from heat, sparks and open flame. Use with adequate ventilation. Product is a respiratory and skin sensitizer. Avoid contact. Product is an eye, skin, and respiratory irritant. Use of safety goggles and chemical resistant gloves recommended. Use of a NIOSH approved respirator required if PELs are exceeded.</p>
First Aid	<p>In case of skin contact, wash thoroughly with soap and water. For eye contact, flush immediately with plenty of water for at least 15 minutes; contact physician. For respiratory problems, remove to fresh air. Wash clothing before re-use. Discard contaminated shoes.</p>
Clean Up	<p>Uncured material can be removed with approved solvent. Cured material can only be removed mechanically. For spillage, collect, absorb, and dispose of in accordance with current, applicable local, state, and federal regulations.</p>

Linear Feet of Sealant per Gallon

Width	Depth	
	Inches	
1/4	308.0	
1/2	154.0	77.0
3/4	102.7	51.3
1	77.0	38.5
1 1/2	61.6	30.8
1 3/4	51.3	25.7

Sikaflex-2c NS EZ Mix Working Time, hours

	73°F	100°F	40°F
Sikaflex-2c NS	4-6 hrs.	3 hrs.	6 hrs.
w/ 1 booster	2 hrs.	1 hr.	2-3 hrs.
w/ 2 boosters	1 hr.	<1 hr.	1.5 hrs.



Construction



KEEP CONTAINER TIGHTLY CLOSED • KEEP OUT OF REACH OF CHILDREN • NOT FOR INTERNAL CONSUMPTION • FOR INDUSTRIAL USE ONLY

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Prior to each use of any Sika product, the user must always read and follow the warnings and instructions on the product's most current Technical Data Sheet, product label and Material Safety Data Sheet which are available online at www.sikausa.com or by calling Sika's Technical Service Department at 800-933-7452. Nothing contained in any Sika materials relieves the user of the obligation to read and follow the warnings and instruction for each Sika product as set forth in the current Technical Data Sheet, product label and Material Safety Data Sheet prior to product use.

LIMITED WARRANTY: Sika warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Technical Data Sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer's sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor. **NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SIKASHALL NOT BELIEGABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. SIKASHALL NOT BE RESPONSIBLE FOR THE USE OF THIS PRODUCT IN A MANNER TO INFRINGE ON ANY PATENT OR ANY OTHER INTELLECTUAL PROPERTY RIGHTS HELD BY OTHERS.**

Visit our website at www.sikausa.com

1-800-933-SIKA NATIONWIDE

Regional Information and Sales Centers. For the location of your nearest Sika sales office, contact your regional center.

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Fax: 514-694-2792

Sika Mexicana S.A. de C.V.
Carretera Libre Celaya Km. 8.5
Fracc. Industrial Balvanera
Corregidora, Queretaro
C.P. 76920
Phone: 52 442 2385800
Fax: 52 442 2250537



RESPONSIBLE CARE



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MATERIAL SAFETY DATA SHEET

Sikaflex® 2C NS EZ Mix - Part A (Limestone and Tint Base)

HMIS

HEALTH	*2
FLAMMABILITY	1
REACTIVITY	0
PERSONAL PROTECTION	C

1. Product And Company Identification

Supplier Sika Corporation 201 Polito Ave Lyndhurst, NJ 07071 Company Contact: EHS Department Telephone Number: 201-933-8800 FAX Number: 201-933-9379 Web Site: www.sikausa.com	Manufacturer Sika Corporation 201 Polito Ave Lyndhurst, NJ 07071 Company Contact: EHS Department Telephone Number: 201-933-8800 FAX Number: 201-933-9379 Web Site: www.sikausa.com
Supplier Emergency Contacts & Phone Number CHEMTREC: 800-424-9300 INTERNATIONAL: 703-527-3887	Manufacturer Emergency Contacts & Phone Number CHEMTREC: 800-424-9300 INTERNATIONAL: 703-527-3887

Issue Date: 08/11/2006

Product Name: Sikaflex® 2C NS EZ Mix - Part A (Limestone and Tint Base)

CAS Number: Not Established

Chemical Family: Polyurethane

MSDS Number: 3967

Product Code: 0764137 / 076413N

2. Composition/Information On Ingredients

Ingredient Name	CAS Number	Percent Of Total Weight
POLYISOCYANATE PREPOLYMER	mixture	
XYLENE (MIXED ISOMERS)	1330-20-7	1 - 5

3. Hazards Identification

Eye Hazards

Causes eye irritation.

Skin Hazards

May cause skin irritation. Prolonged and/or repeated skin contact may cause an allergic reaction/sensitization.

Ingestion Hazards

May be harmful if swallowed.

Inhalation Hazards

May cause nose, throat, and lung irritation. May cause respiratory tract irritation. May cause an allergic respiratory reaction / sensitization after prolonged or repeated contact. Reports have associated repeated and prolonged

MATERIAL SAFETY DATA SHEET

Sikaflex® 2C NS EZ Mix - Part A (Limestone and Tint Base)

3. Hazards Identification - Continued

Inhalation Hazards - Continued

exposure to some of the chemicals in this product with permanent brain, liver, kidney, and Central Nervous System damage. Headaches and dizziness may result.

4. First Aid Measures

Eye

In case of contact, hold eyelids apart and immediately flush eyes with plenty of tepid water for at least 15 minutes. Get medical attention immediately if irritation develops and persists.

Skin

In case of contact, immediately flush skin with soap and plenty of tepid water for at least 15 minutes. Get medical attention immediately if irritation (redness, rash, blistering) develops and persists.

Ingestion

If swallowed, do not induce vomiting unless directed to do so by medical personnel. If victim is fully conscious, give one or two cups of water or milk to drink. Never give anything by mouth to an unconscious victim. Seek medical attention immediately.

Inhalation

Remove to fresh air. If not breathing, give artificial respiration, seek medical attention.

5. Fire Fighting Measures

Flash Point: > 227 °F > 108 °C

Autoignition Point: N/AV °F

Fire And Explosion Hazards

During a fire, irritating and/or toxic gases and aerosols from the decomposition/combustion products may be present.

Extinguishing Media

In case of fire, use water spray (fog) foam, dry chemical, or CO₂.

Fire Fighting Instructions

In the event of a fire, firefighters should wear full protective clothing and NIOSH-approved self-contained breathing apparatus with a full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Avoid release to the environment. Use appropriate Personal Protective Equipment (PPE). Contain spill and collect with absorbent material and transfer into suitable containers. Do not flush to sewer or allow to enter waterways. Ventilate enclosed area.

7. Handling And Storage

Handling And Storage Precautions

Keep out of reach of children. Not for internal consumption.

Storage Precautions

Store at 32F min. - 122F max. Ideal storage temperature 50 - 80F. If closed container is exposed to heat, pressure can build up. If moisture enters container, pressure may build up due to reaction. Store in cool, dry area in tightly closed containers, away from sparks and open flames.

Work/Hygienic Practices

Wash thoroughly with soap and water after handling.

MATERIAL SAFETY DATA SHEET

Sikaflex® 2C NS EZ Mix - Part A (Limestone and Tint Base)

8. Exposure Controls/Personal Protection

Engineering Controls

Use of a system of local and/or general exhaust is recommended to keep employee below applicable exposure limits. Refer to the current edition of "Industrial Ventilation: A Manual of Recommended Practice" published by the American Conference of Governmental Industrial Hygienists for information on the design, installation, use, and maintenance of exhaust systems.

Eye/Face Protection

Safety glasses with side shields or goggles.

Skin Protection

Chemical-resistant gloves. Lab coat or other work clothing to prevent skin exposure (Long sleeve shirt and long pants). Launder before reuse.

Respiratory Protection

A respirator protection program that meets 29 CFR 1910.134 requirement must be followed whenever workplace conditions warrant a respirator's use. In areas where the Permissible Exposure Limits are exceeded, use a properly fitted NIOSH-approved respirator.

Other/General Protection

Wash thoroughly after handling.

Ingredient(s) - Exposure Limits

XYLENE (MIXED ISOMERS)
ACGIH TLV-STEL 150 ppm
ACGIH TLV-TWA 100 ppm
OSHA PEL-TWA 100 ppm

9. Physical And Chemical Properties

Appearance

Mastic

Odor

Aromatic Odor

Chemical Type: Mixture

Physical State: Solid

Melting Point: N/AV °F

Boiling Point: N/AV °F

Specific Gravity: 1.1

Packing Density: 9.2 pounds/gallon

Vapor Pressure: N/AV

Vapor Density: > Air

Solubility: N/AV

Evaporation Rate: Slower than ether

VOC content: Part A: 44 g/l

Part B: 92 g/l

Part A+B: 56 g/l

10. Stability And Reactivity

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions To Avoid (Stability)

Open flame, heat

MATERIAL SAFETY DATA SHEET

Sikaflex® 2C NS EZ Mix - Part A (Limestone and Tint Base)

10. Stability And Reactivity - Continued

Incompatible Materials

Contact with water, alcohols and amines.

Hazardous Decomposition Products

CO, CO₂, Oxides of Nitrogen

11. Toxicological Information

No Data Available...

12. Ecological Information

No Data Available...

13. Disposal Considerations

Dispose in accordance with applicable federal, state and local government regulations. Waste generators must determine whether a discarded material is classified as a hazardous waste. USEPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

14. Transport Information

Proper Shipping Name

Not regulated by the USDOT.

15. Regulatory Information

U.S. Regulatory Information

All ingredients of this product are listed or are excluded from listing under the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

SARA Hazard Classes

Acute Health Hazard

SARA Title III - Section 313 Supplier Notification

This product contains the following toxic chemicals that are subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372.

XYLENE (MIXED ISOMERS) (1330-20-7) 1 - 5 %

This information must be included on all MSDSs that are copied and distributed for this material.

Ingredient(s) - U.S. Regulatory Information

XYLENE (MIXED ISOMERS)

SARA Title III - Section 313 Form "R"/TRI Reportable Chemical

SARA - Acute Health Hazard

SARA - Chronic Health Hazard

SARA - Fire Hazard

Ingredient(s) - State Regulations

XYLENE (MIXED ISOMERS)

New Jersey - Workplace Hazard

New Jersey - Environmental Hazard

New Jersey - Special Hazard

Pennsylvania - Workplace Hazard

Pennsylvania - Environmental Hazard

Massachusetts - Hazardous Substance

MATERIAL SAFETY DATA SHEET

Sikaflex® 2C NS EZ Mix - Part A (Limestone and Tint Base)

15. Regulatory Information - Continued

Ingredient(s) - State Regulations - Continued

New York City - Hazardous Substance

16. Other Information

HMIS Rating

Health: *2

Fire: 1

Reactivity: 0

PPE: C

Revision/Preparer Information

MSDS Preparer: EHS Department

MSDS Preparer Phone Number: 201-933-8800

This MSDS Supersedes A Previous MSDS Dated: 07/21/2006

Disclaimer

The information contained in this Material Safety Data Sheet applies only to the actual Sika Corporation ("Sika") product identified and described herein. This information is not intended to address, nor does it address the use or application of the identified Sika product in combination with any other material, product or process. All of the information set forth herein is based on technical data regarding the identified product that Sika believes to be reliable as of the date hereof. Prior to each use of any Sika product, the user must always read and follow the warnings and instructions on the product's current Technical Data Sheet, product label and Material Safety Data Sheet for each Sika product, which are available at web site and/or telephone number listed in Section 1 of this MSDS.

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SIKA CORPORATION

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MATERIAL SAFETY DATA SHEET

Sikaflex® 2C, NS & SL - Part B

HMIS

HEALTH	*2
FLAMMABILITY	2
REACTIVITY	0
PERSONAL PROTECTION	C

1. Product And Company Identification

Supplier

Sika Corporation
201 Polito Ave
Lyndhurst, NJ 07071

Company Contact: EHS Department
Telephone Number: 201-933-8800
FAX Number: 201-933-9379
Web Site: www.sikausa.com

Manufacturer

Sika Corporation
201 Polito Ave
Lyndhurst, NJ 07071

Company Contact: EHS Department
Telephone Number: 201-933-8800
FAX Number: 201-933-9379
Web Site: www.sikausa.com

Supplier Emergency Contacts & Phone Number

CHEMTREC: 800-424-9300
INTERNATIONAL: 703-527-3887

Manufacturer Emergency Contacts & Phone Number

CHEMTREC: 800-424-9300
INTERNATIONAL: 703-527-3887

Issue Date: 07/21/2006

Product Name: Sikaflex® 2C, NS & SL - Part B
CAS Number: Not Established
Chemical Family: Polyurethane
MSDS Number: 3705
Product Code: 0464140

2. Composition/Information On Ingredients

Ingredient Name	CAS Number	Percent Of Total Weight
POLYISOCYANATE PREPOLYMER	mixture	
XYLENE (MIXED ISOMERS)	1330-20-7	5 - 10

3. Hazards Identification

Eye Hazards

Causes eye irritation.

Skin Hazards

May cause skin irritation. Prolonged and/or repeated skin contact may cause an allergic reaction/sensitization.

Ingestion Hazards

May be harmful if swallowed.

Inhalation Hazards

May cause nose, throat, and lung irritation. May cause respiratory tract irritation. May cause an allergic respiratory reaction / sensitization after prolonged or repeated contact. Reports have associated repeated and prolonged

MATERIAL SAFETY DATA SHEET

Sikaflex® 2C, NS & SL - Part B

3. Hazards Identification - Continued

Inhalation Hazards - Continued

exposure to some of the chemicals in this product with permanent brain, liver, kidney, and Central Nervous System damage. Headaches and dizziness may result.

4. First Aid Measures

Eye

In case of contact, hold eyelids apart and immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately.

Skin

In case of contact, immediately flush skin with soap and plenty of water. Get medical attention immediately if irritation (redness, rash, blistering) develops and persists.

Ingestion

If victim is fully conscious, give one or two cups of water or milk to drink. Never give anything by mouth to an unconscious victim. Call a physician or a poison control center immediately.

Inhalation

Remove to fresh air. If not breathing, give artificial respiration, seek medical attention.

5. Fire Fighting Measures

Flash Point: 112 °F

Autoignition Point: N/AV °F

Lower Explosive Limit: N/AV

Upper Explosive Limit: N/AV

Fire And Explosion Hazards

Combustible liquid. During a fire, irritating and/or toxic gases and aerosols from the decomposition/combustion products may be present.

Extinguishing Media

In case of fire, use water spray (fog) foam, dry chemical, or CO2.

Fire Fighting Instructions

In the event of a fire, firefighters should wear full protective clothing and NIOSH-approved self-contained breathing apparatus with a full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Eliminate all ignition sources. Use appropriate Personal Protective Equipment (PPE). Absorb and/or contain spill with inert materials (e.g. sand, vermiculite) and then place in appropriate container. For large spills, use water spray to disperse vapors. Prevent runoff from entering waterways or sewers.

7. Handling And Storage

Handling And Storage Precautions

Keep out of reach of children. Not for internal consumption.

Handling Precautions

Keep away from heat, sparks, flame, and other sources of ignition (i.e., pilot lights, electric motors, and static electricity).

Storage Precautions

Store at 32F min. - 122F max. Ideal storage temperature 50-80F. If closed container is exposed to heat, pressure can build up. If moisture enters container, pressure may build up due to reaction. Store in cool, dry area in tightly closed containers, away from sparks and open flames.

MATERIAL SAFETY DATA SHEET

Sikaflex® 2C, NS & SL - Part B

7. Handling And Storage - Continued

Work/Hygienic Practices

Wash thoroughly with soap and water after handling.

8. Exposure Controls/Personal Protection

Engineering Controls

Use of a system of local and/or general exhaust is recommended to keep employee below applicable exposure limits. Refer to the current edition of "Industrial Ventilation: A Manual of Recommended Practice" published by the American Conference of Governmental Industrial Hygienists for information on the design, installation, use, and maintenance of exhaust systems.

Eye/Face Protection

Faceshield over safety glasses or goggles.

Skin Protection

Chemical-resistant gloves. Lab coat or other work clothing to prevent skin exposure. Launder before reuse.

Respiratory Protection

A respirator protection program that meets 29 CFR 1910.134 requirement must be followed whenever workplace conditions warrant a respirator's use. In areas where the Permissible Exposure Limits are exceeded, use a properly fitted NIOSH-approved respirator.

Other/General Protection

Wash thoroughly after handling.

Ingredient(s) - Exposure Limits

XYLENE (MIXED ISOMERS)
ACGIH TLV-STEL 150 ppm
ACGIH TLV-TWA 100 ppm
OSHA PEL-TWA 100 ppm

9. Physical And Chemical Properties

Appearance

Clear liquid

Odor

Aromatic Odor

Chemical Type: Mixture

Physical State: Liquid

Specific Gravity: 1.02

Percent Volatiles: 9.0

Packing Density: 8.5 pounds/gallon

Vapor Density: > AIR

Evaporation Rate: Slower than ether

VOC content: Part A: 69 g/l

Part B: 92 g/l

A+B: 75 g/l

10. Stability And Reactivity

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions To Avoid (Stability)

Open flame, heat

MATERIAL SAFETY DATA SHEET

Sikaflex® 2C, NS & SL - Part B

10. Stability And Reactivity - Continued

Incompatible Materials

Water, Alcohols and Amines

Hazardous Decomposition Products

CO, CO₂, Oxides of Nitrogen

11. Toxicological Information

No Data Available...

12. Ecological Information

No Data Available...

13. Disposal Considerations

Dispose in accordance with applicable federal, state and local government regulations. Waste generators must determine whether a discarded material is classified as a hazardous waste. USEPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

14. Transport Information

Proper Shipping Name

Ground Transport - Not Regulated by the USDOT (per 49 CFR 173.150(f))
Air, Boat Transport - Flammable Liquids, N.O.S., (Xylene), 3, UN1993, PG III

Additional Shipping Paper Description

Note: This product is packaged for ground transport only.

15. Regulatory Information

U.S. Regulatory Information

All ingredients of this product are listed or are excluded from listing under the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

SARA Hazard Classes

Acute Health Hazard
Chronic Health Hazard
Fire Hazard

SARA Title III - Section 313 Supplier Notification

This product contains the following toxic chemicals that are subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372.

XYLENE (MIXED ISOMERS) (1330-20-7) 5 - 10 %

This information must be included on all MSDSs that are copied and distributed for this material.

Ingredient(s) - U.S. Regulatory Information

XYLENE (MIXED ISOMERS)
SARA Title III - Section 313 Form "R"/TRI Reportable Chemical
SARA - Acute Health Hazard
SARA - Chronic Health Hazard
SARA - Fire Hazard

Ingredient(s) - State Regulations

XYLENE (MIXED ISOMERS)
New Jersey - Workplace Hazard

MATERIAL SAFETY DATA SHEET

Sikaflex® 2C, NS & SL - Part B

15. Regulatory Information - Continued

Ingredient(s) - State Regulations - Continued

New Jersey - Environmental Hazard
New Jersey - Special Hazard
Pennsylvania - Workplace Hazard
Pennsylvania - Environmental Hazard
Massachusetts - Hazardous Substance
New York City - Hazardous Substance

16. Other Information

HMIS Rating

Health: *2
Fire: 2
Reactivity: 0
PPE: C

Revision/Preparer Information

MSDS Preparer: EHS Department
This MSDS Supersedes A Previous MSDS Dated: 05/16/2005

Disclaimer

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SIKA CORPORATION

Printed Using MSDS Generator™ 2000

Sikaflex® Sealant/Adhesive Primers

Sikaflex Primers 260, 429, and 449

Construction

Description	Sikaflex primers are special materials formulated to improve the bond of Sikaflex urethane sealants when applied to specific substrates.						
Sikaflex Primer 260	Sikaflex Primer 260 promotes adhesion of urethane sealants to various metallic, non-metallic, and plastic substrates.						
Sikaflex Primer 429	Sikaflex Primer 429 promotes adhesion to clean, sound, and dry concrete, masonry, Exterior Insulation Finish Systems (EIFS), and wood — including teak and mahogany.						
Sikaflex Primer 449	Sikaflex Primer 449 is used to promote adhesion to pvc, solvent-based enamel, PPG's fluorocarbon Duranar-finish, and certain plastics such as ABS and Plexiglass.						
Where to Use	Most substrates require a primer only if testing shows need for it or where the sealant will be underwater after cure. Certain substrates do require a primer under all conditions.						
Advantages	<ul style="list-style-type: none"> ■ Single-component, ready to use. ■ Easily applied by brush, dauber, or spray. 						
Coverage	<p>Following are average coverages, depending on porosity of substrate:</p> <p>Sikaflex Primer Coverage per pint (Liner ft. 1/2" x 1/2" joint)</p> <table border="1"> <tr> <td>260</td> <td>300-500</td> </tr> <tr> <td>429</td> <td>300</td> </tr> <tr> <td>449</td> <td>300-500</td> </tr> </table>	260	300-500	429	300	449	300-500
260	300-500						
429	300						
449	300-500						
Packaging	<p>Sikaflex 260 and 449 primers are available in pints, 6/carton.</p> <p>Sikaflex 429 primer is available in pints, 6/carton; and gallons, 2/carton.</p>						

Substrate	Primer Required	Recommended primer if necessary
Concrete and Masonry		
Concrete Block	No	Sikaflex 429 primer
Placed Concrete	No	Sikaflex 429 primer
Precast Concrete	No	Sikaflex 429 primer
Mortar	No	Sikaflex 429 primer
Grout	No	Sikaflex 429 primer
Brick	No	Sikaflex 429 primer
SikaTops	No	Sikaflex 429 primer
Stone		
Granite	No	Sikaflex 429 primer
Marble	No	Sikaflex 260 primer
Paints		
Acrylic Latex	No Bond Achieved	
Emercoat 33	No Bond Achieved	
DeSolo Fluoropon	No Bond Achieved	
PPG Duracon S600	No Bond Achieved	
Solvent-based Enamel	Yes	Sikaflex 449 primer
PPG Fluorocarbon	Yes	Sikaflex 449 primer
Duranar	Yes	Sikaflex 449 primer
PPG Polycron	Yes	Sikaflex 449 primer
Kynar	Yes	Sikaflex 449 primer
Siliconized Polyester	Yes	Sikaflex 260 primer
Alucobond	Yes	Sikaflex 260 primer
Plastics		
PVC	Yes	Sikaflex 449 primer
ABS	Yes	Sikaflex 449 primer
Plexiglass	Yes	Sikaflex 449 primer
Plexiglass DR	Yes	Sikaflex 449 primer
Lucite	Yes	Sikaflex 449 primer
Rovel Plastic	Yes	Sikaflex 449 primer

Substrate	Primer Required	Recommended primer if necessary
Plastics cont'd		
Lexan	Yes	Sikaflex 260 primer
Teflon	No Bond Achieved	
Polyethylene	No Bond Achieved	
Polypropylene	No Bond Achieved	
Tuffak	Yes	Sikaflex 449 primer
Polyester/Fiberglass	No	Sikaflex 449 primer
Glass		
Glass - Sheet, float or plate	No	Sikaflex 260 primer
Porcelain	No	Sikaflex 260 primer
Ceramic tile	No	Sikaflex 260 primer
Metals		
Aluminum - Anodized	No	Sikaflex 260 primer
Aluminum - Mill Finish	Yes	Sikaflex 260 primer
Lead	No	Sikaflex 260 primer
Copper (bright/clean)	No	Sikaflex 260 primer
Brass	No	Sikaflex 260 primer
Zinc	No	Sikaflex 260 primer
Tinplate	No	Sikaflex 260 primer
Steel (Bright/Clean)	No	Sikaflex 260 primer
Steel - Stainless	Yes	Sikaflex 260 primer
Steel - Galvanized	Yes	Sikaflex 260 primer
Rubber		
Urethane	No	Sikaflex 449 primer
Woods		
Unfinished Woods	No	Sikaflex 429 primer
EIFS**		
Dryvit	Yes	Sikaflex 429 primer
Sto	Yes	Sikaflex 429 primer
Synergy	Yes	Sikaflex 429 primer

** Product will bond without primer however primer is recommended by EIFS manufacturers to properly seal substrate. Follow EIFS manufacturer's primer recommendations.

Typical Data (Material and curing conditions 73°F and 50% R.H.)

RESULTS MAY DIFFER BASED UPON STATISTICAL VARIATIONS DEPENDING UPON MIXING METHODS AND EQUIPMENT, TEMPERATURE, APPLICATION METHODS, TEST METHODS, ACTUAL SITE CONDITIONS AND CURING CONDITIONS.

Color Clear
Shelf life 6 months in original, unopened containers.



How to Use Surface Preparation

The key to good bonding with Sikaflex sealants/primers is surface preparation. Specifically, all surfaces must be dry and free of dirt, grease, mold release agents, loose mortar, laitance, and any foreign matter. If the joint contains old sealant, it and all extraneous material must be removed and the substrate cleaned by mechanical means. Apply primers at substrate temperatures of 40°F and rising. Surface must be frost free.

Application

Shake or stir primer well before using. Apply to dry, clean, oil free surface with a brush, dauber or spray.

Sikaflex Primer	Dry time before installing sealant	
260	>1 hr.	<8 hrs.*
429	>1 hr.	<8 hrs.*
449	>30 min.	<8 hrs.*

* If sealant cannot be installed within 8 hours of priming, reprime.

Limitations

- Primer should not be used if it starts to gel in container.
- Protect Sikaflex primers from moisture. Once container has been opened, use contents immediately.
- Do not attempt to use partial containers.
- Do not reseal or reuse. Resealing may cause moisture contamination and gelling.

Caution

Sikaflex Primer 260

Flammable; Irritant; Poison - Contains methanol. May cause skin/eye/respiratory irritation. Avoid contact. Methanol is a poison and may cause blindness if ingested. Use only with adequate ventilation. Use of safety goggles and chemical resistant gloves is recommended. In case of exceedance of PELs, use an appropriate, properly fitted NIOSH approved respirator. Remove contaminated clothing. Keep away from heat, sparks, and open flames.

Sikaflex Primer 429

Flammable; Irritant; Sensitizer - Contains aromatic polyisocyanate, xylene, PGMEA, TDI. May cause skin/eye/respiratory irritation. May cause skin and/or respiratory sensitization after prolonged or repeated contact. Avoid contact. May cause headaches, dizziness or other CNS effects. TDI is a suspect carcinogen (IARC, NTP). Use only with adequate ventilation. Use of safety goggles and chemical resistant gloves is recommended. In case of exceedance of PELs, use an appropriate, properly fitted NIOSH approved respirator. Remove contaminated clothing. Keep away from heat, sparks, and open flames.

Sikaflex Primer 449

Flammable; Irritant; Sensitizer - Contains xylene, butyl acetate, methylethyl ketone, toluene. May cause skin/eye/respiratory irritation. May cause skin and/or respiratory sensitization after prolonged or repeated contact. Avoid contact. May cause headaches, dizziness or other CNS effects. Use only with adequate ventilation. Use of safety goggles and chemical resistant gloves is recommended. In case of exceedance of PELs, use an appropriate, properly fitted NIOSH approved respirator. Remove contaminated clothing. Keep away from heat, sparks, and open flames.

First Aid

In case of skin contact, wash immediately and thoroughly with soap and water. If symptoms persist, consult physician. For eye contact, flush immediately with plenty of water for at least 15 minutes; contact a physician. For respiratory problems, remove person to fresh air; if symptoms persist, consult physician. In case of ingestion, consult a physician immediately - methanol is a poison. Remove contaminated clothing.

Clean Up

In case of spill or leaks, wear suitable protective equipment, contain spill, collect with absorbent material, and transfer to suitable container. Ventilate area. Avoid contact. Dispose of in accordance with current, applicable, local, state and federal regulations.

KEEP CONTAINER TIGHTLY CLOSED - KEEP OUT OF REACH OF CHILDREN - NOT FOR INTERNAL CONSUMPTION - FOR INDUSTRIAL USE ONLY

All information provided by Sika Corporation ("Sika") concerning Sika products, including but not limited to, any recommendations and advice relating to the application and use of Sika products, is given in good faith based on Sika's current experience and knowledge of its products when properly stored, handled and applied under normal conditions in accordance with Sika's instructions. In practice, the differences in materials, substrates, storage and handling conditions, actual site conditions and other factors outside of Sika's control are such that Sika assumes no liability for the provision of such information, advice, recommendations or instructions related to its products, nor shall any legal relationship be created by or arise from the provision of such information, advice, recommendations or instructions related to its products. The user of the Sika product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with the full application of the product(s). Sika reserves the right to change the properties of its products without notice. All sales of Sika product(s) are subject to its current terms and conditions of sale which are available at www.sikausa.com or by calling 800-933-7452.

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Visit our website at www.sikausa.com

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Regional Information and Sales Centers. For the location of your nearest Sika sales office, contact your regional center.

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**1. Product and company identification**

Product name	Sikaflex® Primer 429/202
Supplier	Sika Corporation Polito Avenue 201 Lyndhurst, NJ 07071
Telephone	(201) 933-8800
Telefax	(201) 804-1076
Emergency telephone	CHEMTREC: 800-424-9300
e-mail address of person responsible for this SDS	INTERNATIONAL: 703-527-3887 ehs@sika-corp.com
Manufacturer	Sika Corporation, Operations 201 Polito Avenue Lyndhurst, NJ 07071 www.sikausa.com
Telephone	(201) 933 - 8800
Chemical family	Polyurethane

2. Hazards identification

This material is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.

Potential Health Effects

Inhalation	Harmful if inhaled. May cause allergic respiratory reaction.
Skin	May cause allergic skin reaction. Causes skin irritation. Harmful if absorbed through skin.
Eyes	Causes eye irritation.
Ingestion	Harmful if swallowed.
Warning	Causes central nervous system depression Possible cancer hazard. Contains material which may cause cancer based on animal data.

See Section 11 for more detailed information on health effects and symptoms.

3. Composition/information on ingredients

<u>Component</u>	<u>CAS Number</u>
aromatic polyisocyanate prepolymer	Unknown
xylene	1330-20-7
2-methoxy-1-methylethyl acetate	108-65-6
ethylbenzene	100-41-4
4-methyl-m-phenylene diisocyanate	584-84-9



There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4. First aid measures

First aid procedures

Inhalation	If inhaled, remove to fresh air. If breathing is difficult, trained personnel should give oxygen. If not breathing, give artificial respiration. Get medical attention immediately.
Skin contact	In case of contact, immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Destroy contaminated shoes and clothing. Get medical attention immediately if irritation develops and persists.
Eye contact	If easy to do, remove contact lens, if worn. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.
Ingestion	If swallowed, contact a poison control center or physician immediately. Do NOT induce vomiting unless directed to do so by medical personnel Never give anything by mouth to an unconscious person. Get medical attention immediately.

Notes to physician

Treatment	No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
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5. Fire-fighting measures

Fire fighting

Suitable extinguishing media	Foam Carbon dioxide (CO2) Dry chemical
Unsuitable extinguishing media	Water
Further information	Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk without suitable training.

Protective equipment and precautions for firefighters

Specific hazards during fire	Flammable Liquid
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fighting	Do not use a solid water stream as it may scatter and spread fire. Risk of a subsequent explosion. In a fire or if heated, a pressure increase will occur and the container may burst. Cool closed containers exposed to fire with water spray.
Special protective equipment for fire-fighters	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

6. Accidental release measures

Personal precautions	Use personal protective equipment. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. No action shall be taken involving any personal risk without suitable training. Keep people away from and upwind of spill/leak. Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas. Material can create slippery conditions.
Environmental precautions	Local authorities should be advised if significant spillages cannot be contained. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
Methods for containment and cleaning up	Contain spillage, soak up with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and transfer to a container for disposal according to local / national regulations (see section 13). Large spills should be collected mechanically (remove by pumping) for disposal. For large spills, use water spray to disperse vapors, flush spill area.

7. Handling and storage

Handling	For personal protection see section 8. Avoid inhalation, ingestion and contact with skin and eyes. Smoking, eating and drinking should be prohibited in the application area. Use explosion-proof equipment. No sparking tools should be used. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Ensure all equipment is electrically grounded before beginning transfer operations. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Storage	Vapors are heavier than air and may spread along floors. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Keep product and empty container away from heat and sources of ignition.



Keep containers tightly closed in a dry, cool and well-ventilated place.
 Keep in properly labeled containers.
 To maintain product quality, do not store in heat or direct sunlight.
 Store in accordance with local regulations.

8. Exposure controls/personal protection

Exposure limit(s)

<u>Component</u>	<u>CAS Number</u>	<u>Content %</u>	<u>Basis *</u>	<u>Value</u>	<u>Exposure limit(s) / Form of exposure</u>
xylene	1330-20-7	10 - 30	ACGIH	TWA	100 ppm
			ACGIH	STEL	150 ppm
			OSHA P1	TWA	100 ppm 435 mg/m3
			OSHA P0	TWA	100 ppm 435 mg/m3
			OSHA P0	STEL	150 ppm 655 mg/m3
ethylbenzene	100-41-4	5 - 10	ACGIH	TWA	100 ppm
			ACGIH	STEL	125 ppm
			OSHA P1	TWA	100 ppm 435 mg/m3
			OSHA P0	TWA	100 ppm 435 mg/m3
			OSHA P0	STEL	125 ppm 545 mg/m3
4-methyl-m-phenylene diisocyanate	584-84-9	0.1 - 1	ACGIH	TWA	0.005 ppm
			ACGIH	STEL	0.02 ppm
			OSHA P1	C	0.02 ppm 0.14 mg/m3
			OSHA P0	TWA	0.005 ppm 0.04 mg/m3
			OSHA P0	STEL	0.02 ppm 0.15 mg/m3



Material Safety Data Sheet

Sikaflex® Primer 429/202

Revision Date 03/28/2012

Print Date 03/28/2012

* Basis

ACGIH. Threshold Limit Values (TLV)

OSHA P0. Table Z-1, Limit for Air Contaminant (1989 Vacated Values)

OSHA P1. Permissible Exposure Limits (PEL), Table Z-1, Limit for Air Contaminant

OSHA P2. Permissible Exposure Limits (PEL), Table Z-2

OSHA Z3. Table Z-3, Mineral Dust

Engineering measures Use explosion-proof equipment.
Use of adequate ventilation should be sufficient to control worker exposure to airborne contaminants. If the use of this product generates dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure below any recommended or statutory limits.
The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits.

Personal protective equipment

Eye protection Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary.

Hand protection Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Skin and body protection Choose body protection according to the amount and concentration of the dangerous substance at the work place.

Respiratory protection Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary.
The filter class for the respirator must be suitable for the maximum expected contaminant concentration (gas/vapor/aerosol/particulates) that may arise when handling the product. If this concentration is exceeded, self-contained breathing apparatus must be used.

Hygiene measures Avoid contact with skin, eyes and clothing.
Handle in accordance with good industrial hygiene and safety practice.
Wash hands before breaks and immediately after handling the product.
Remove respiratory and skin/eye protection only after vapors have been cleared from the area.
Remove contaminated clothing and protective equipment before entering eating areas.
Wash thoroughly after handling.

9. Physical and chemical properties

Appearance

Form liquid
Color yellow

Safety data

Flash point 86 °F (30 °C)



Material Safety Data Sheet

Sikaflex® Primer 429/202

Revision Date 03/28/2012

Print Date 03/28/2012

Boiling point/boiling range	300 °F (149 °C)
Boiling point	
Density	1.07 g/cm ³ at 68 °F (20 °C)
Viscosity, kinematic	> 7 mm ² /s at 104 °F (40 °C)
Volatile organic compounds (VOC) content	491.5 g/l

10. Stability and reactivity

Stability	Stable under normal conditions.
Conditions to avoid	Extremes of temperature and direct sunlight. Do not allow vapor to accumulate in low or confined areas. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Avoid all possible sources of ignition (spark or flame).
Materials to avoid	oxidizing materials
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11. Toxicological information

Chronic Exposure	Once sensitized, a severe allergic reaction may occur when subsequently exposed to very low levels. Reports have associated repeated and prolonged exposure to some of the chemicals in this product with permanent brain, liver, kidney and nervous system damage. Intentional misuse by deliberate concentration and inhalation of vapors may be harmful or fatal.
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Carcinogenicity

IARC	Group 2B: Possibly carcinogenic to humans ethylbenzene 100-41-4 4-methyl-m-phenylene diisocyanate 584-84-9
OSHA	not applicable
NTP	not applicable
ACGIH	Confirmed animal carcinogen with unknown relevance to humans: The agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that may not be relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence does not suggest that the agent is likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure. ethylbenzene 100-41-4

12. Ecological information



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Print Date 03/28/2012

Other information

Do not empty into drains; dispose of this material and its container in a safe way.
Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

13. Disposal considerations

Waste disposal methods

Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements.

Packaging

Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	1866
Description of the goods	Resin solution
Class	3
Packing group	III
Labels	3
Emergency Response	127
Guidebook Number	

IATA

UN number	1866
Description of the goods	Resin solution
Class	3
Packing group	III
Labels	3
Packing instruction (cargo aircraft)	366
Packing instruction (passenger aircraft)	355
Packing instruction (passenger aircraft)	Y344

IMDG

UN number	1866
Description of the goods	RESIN SOLUTION
Class	3
Packing group	III
Labels	3
EmS Number 1	F-E
EmS Number 2	S-E

Marine pollutant no

DOT: For Limited Quantity exceptions reference 49 CFR 173.150 (b)

IATA: For Limited Quantity provisions reference IATA DGR Section 2.7 and other applicable sections.

IMDG: For Limited Quantity special provisions reference IMDG Code Chapter 3.4



15. Regulatory information

Federal Regulations

TSCA Status	On TSCA Inventory
SARA 311/312 Hazards	Fire Hazard Acute Health Hazard Chronic Health Hazard

EPCRA - Emergency Planning Community Right - To - Know

SARA 302 Ingredients	not applicable		
SARA 313 Ingredients	ethylbenzene	100-41-4	5.5 %
	xylene	1330-20-7	22.5 %

Clean Air Act

Ozone-Depletion Potential This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

The following chemical(s) are listed as HAP under the U.S. Clean Air Act, Section 12 (40 CFR 61):
ethylbenzene 100-41-4 5.5 %
xylene 1330-20-7 22.5 %

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).

State Regulations

California Prop. 65 Ingredients WARNING! This product contains a chemical known in the State of California to cause cancer.

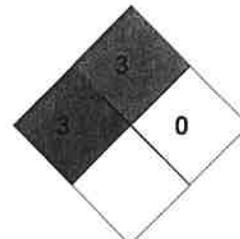
WARNING! This product contains a chemical known in the State of California to cause birth defects or other reproductive harm.

16. Other information

HMIS Classification

Health	*	3
Flammability		3
Physical Hazard		0
Personal Protection		H

NFPA Classification





Material Safety Data Sheet

Sikaflex® Primer 429/202

Revision Date 03/28/2012

Print Date 03/28/2012

Caution: HMIS[®] ratings and NFPA ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS[®] and NFPA ratings are not required on MSDSs under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS[®] and NFPA ratings are to be used with a fully implemented HMIS[®] and NFPA program. HMIS[®] is a registered mark of the National Paint & Coatings Association (NPCA). NFPA or the National Fire Protection Association is a private non-profit organization and an authoritative source of technical background, data, and consumer advice on fire protection, problems and prevention. Please note HMIS[®] attempts to convey full health warning information to all employees while NFPA is meant primarily for fire fighters and other emergency responders.

Notes to Reader

The information contained in this Material Safety Data Sheet applies only to the actual Sika Corporation ("Sika") product identified and described herein. This information is not intended to address, nor does it address the use or application of the identified Sika product in combination with any other material, product or process. All of the information set forth herein is based on technical data regarding the identified product that Sika believes to be reliable as of the date hereof. Prior to each use of any Sika product, the user must always read and follow the warnings and instructions on the product's current Technical Data Sheet, product label and Material Safety Data Sheet for each Sika product, which are available at web site and/or telephone number listed in Section 1 of this MSDS.

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**APPENDIX E: DEPARTMENT OF WATER RESOURCES, DIVISION
OF SAFETY OF DAMS (DSOD), 2011 REPORT**

STATE OF CALIFORNIA
CALIFORNIA NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone Dam No. 1061 County Los Angeles
 Type of Dam Rectangular Concrete Tank Type of Spillway Concrete weir and pipe
 Water is W: 19.5* feet below spillway crest and W: 20.3 feet below dam crest.
 East: Empty, West: El. 607.7
 Weather Conditions Clear, mild, light breeze.
 Contacts Made J. Merluzzo (City of Beverly Hills)
 Reason for Inspection Periodic inspection

Important Observations, Recommendations or Actions Taken

East tank empty and the interior was fully inspected.

Conclusions

From the known information and the visual inspection, the dam, reservoir, and appurtenances are judged safe for continued.

Observations and Comments

<u>Dam</u>	The crest and roof of the dam and reservoir is a parking lot. Only minor and old shrinkage cracking which is normally associated with asphaltic surfaces was noted. The concrete comprising the interior walls, floor slab, columns, and roof of the empty east tank appeared to remain in satisfactory condition with no evidence of distress or instability. One bulge on the east wall of the east tank was noted but it appears that the wall was constructed this way; possibly from movement of the forms during concrete placement. The floor joints appear well sealed and aligned. The concrete comprising the visible portion of the interior walls, floor slab, columns, and roof of the west tank appeared to remain in satisfactory condition with no evidence of distress or instability. The visible floor joints appear well sealed and aligned. The downstream buttress fill has been landscaped and no evidence of instability or distress was noted.
<u>Spillway</u>	The spillway approach was viewed from inside the east tank and from the access hatch and found to be open and clear. The concrete comprising the weir and pipe was also in satisfactory condition with no evidence of distress or instability.
<u>Outlet</u>	The logs show that all of the valves were fully cycled on 10/14/11 with no difficulties encountered. The controls, operators, stems, and valves remain in satisfactory and operable condition.
<u>Seepage</u>	The three seepage underdrains were dry. The canyon underdrain flow could not be measured because of flows from the washout of the east tank.
<u>Instr.</u>	There are no instrumentation submittals for this dam and no new instrumentation or submittals are judged necessary at this time.

**Richard
Draeger, P.E.**
Digitally signed by Richard Draeger, P.E.
 DN: cn=Richard Draeger, P.E.,
 o=DWR - DSOD, ou=Senior
 Engineer, email=rdraeger@water.
 ca.gov, c=US
 Date: 2011.11.14 09:13:55 -08'00'

Photos taken? Yes No
 cc for Owner/Book

Inspected by R. G. Draeger
 Date of Inspection 10/19/2011
 Date of Report 11/10/2011

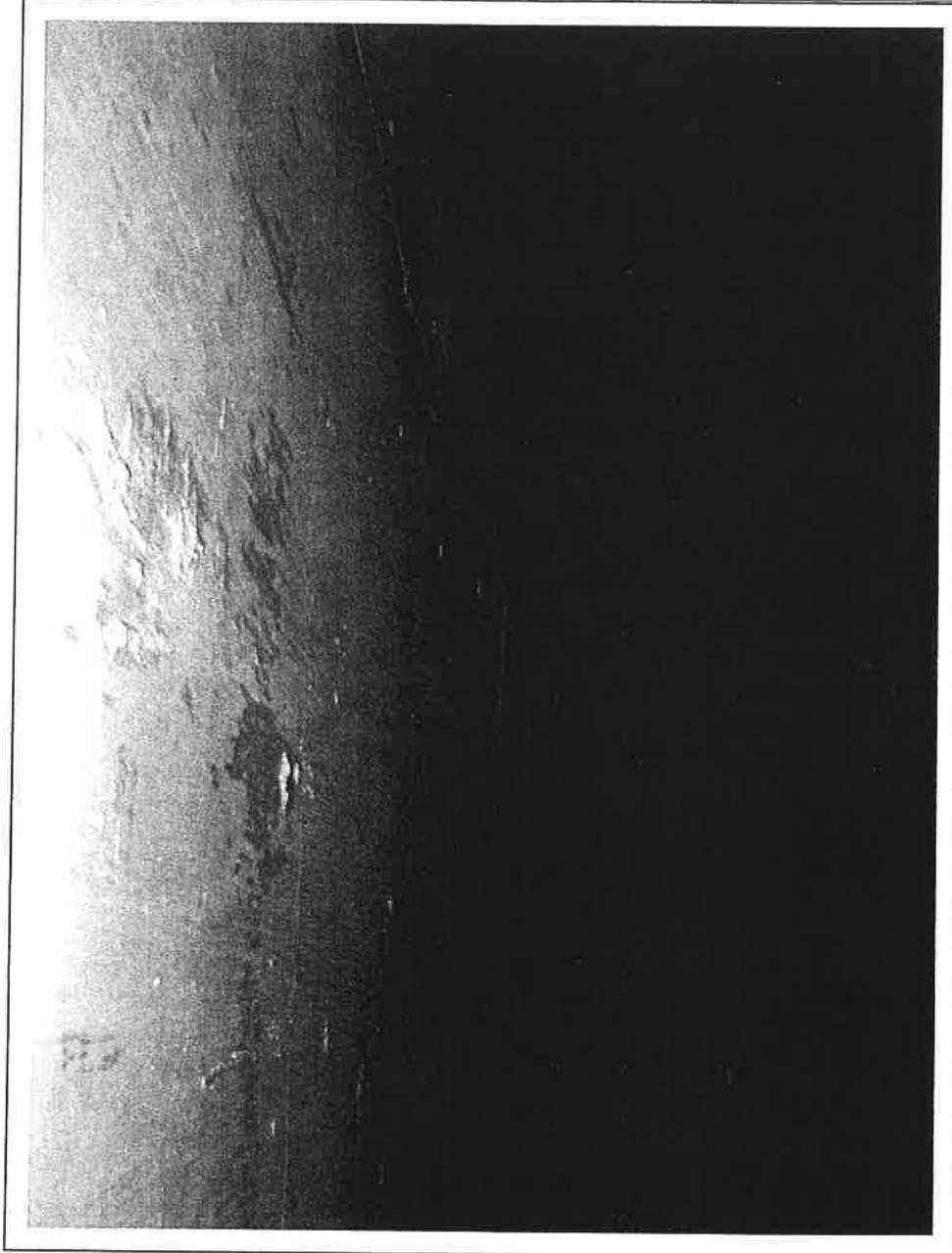
INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

Dam No. 1061

Date of Inspection October 19, 2011

Observations and Comments



Bulge in east wall of east tank which was probably due to movement of the formwork when the concrete for the wall was placed. No distress of the concrete noted.

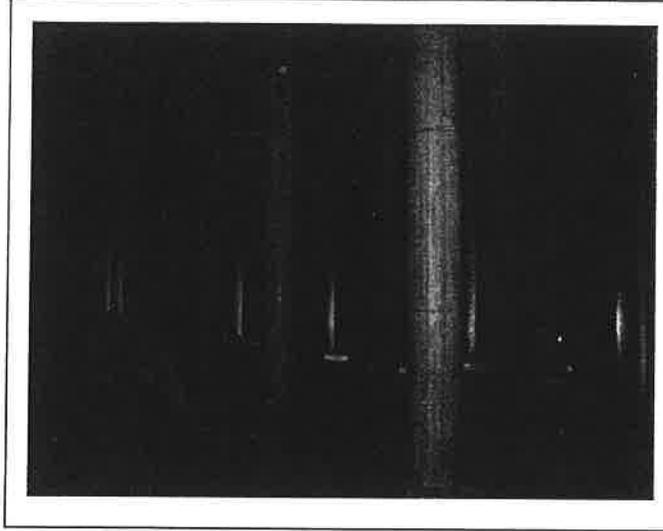
INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

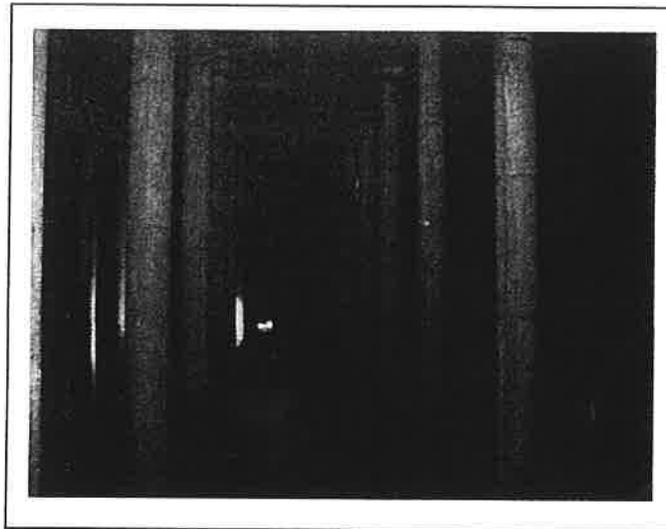
Dam No. 1061

Date of Inspection October 19, 2011

Observations and Comments



Interior of east tank from northeast corner.



Interior of east tank from southeast corner.

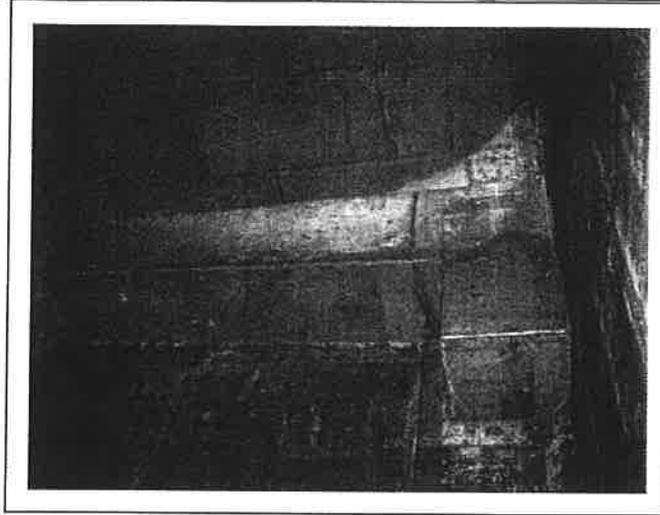
INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

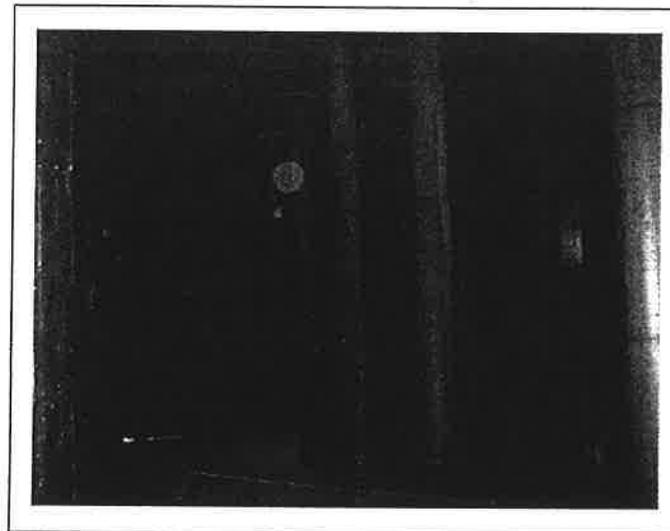
Dam No. 1061

Date of Inspection October 19, 2011

Observations and Comments



View of spillway overflow box.



View of interior from southwest corner.

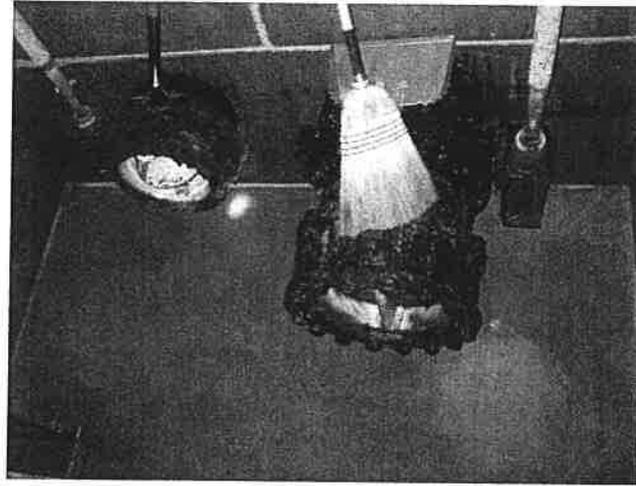
INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

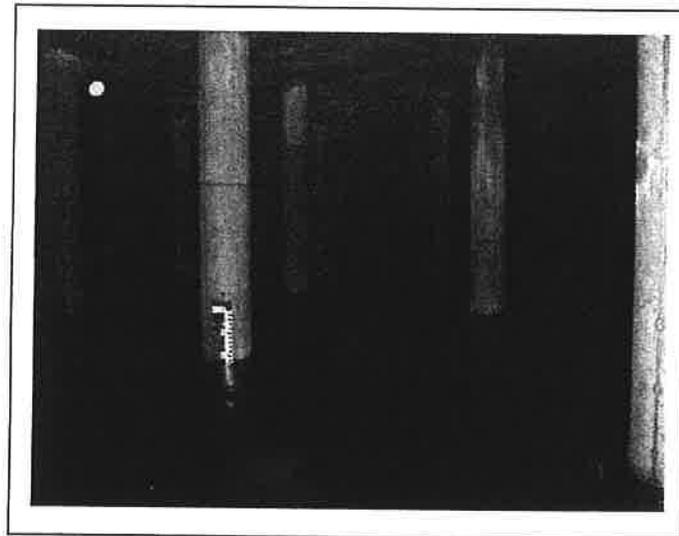
Dam No. 1061

Date of Inspection October 19, 2011

Observations and Comments



View of inlet and outlet valves in vault in east tank.



View of interior of west tank from stairwell.

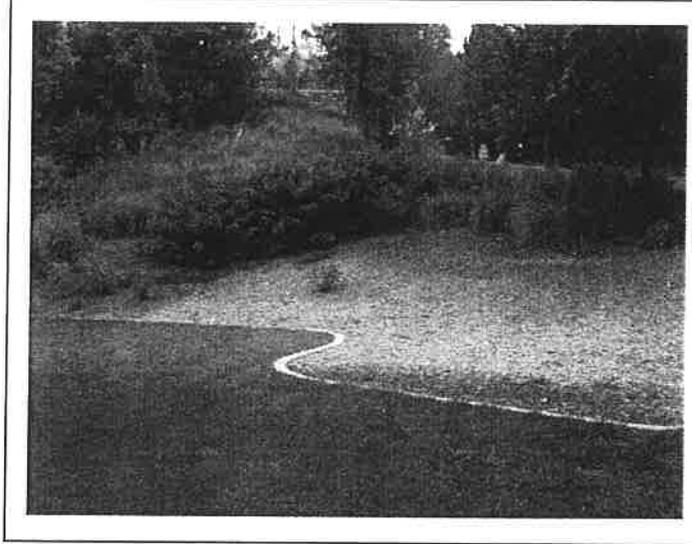
INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

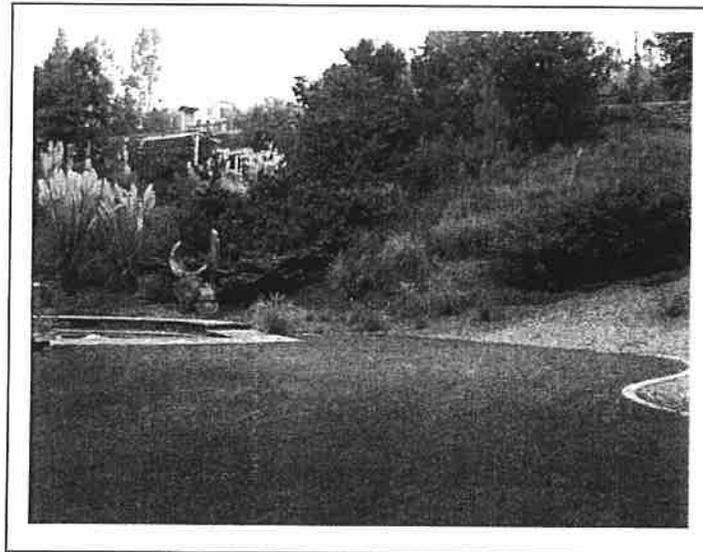
Dam No. 1061

Date of Inspection October 19, 2011

Observations and Comments



View of landscaping on downstream slope.



View of landscaping on downstream slope. Note koi pond just beyond toe.

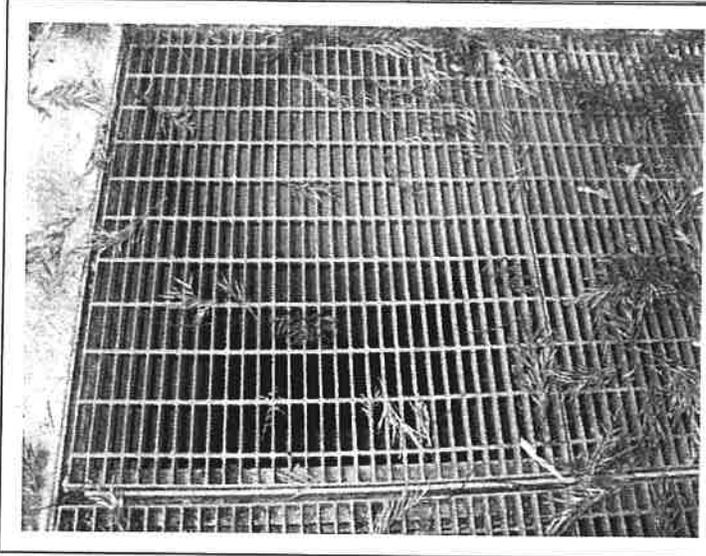
INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

Dam No. 1061

Date of Inspection October 19, 2011

Observations and Comments



View of seepage drain outfall vault.



View of access shaft to spillway box and pipe.

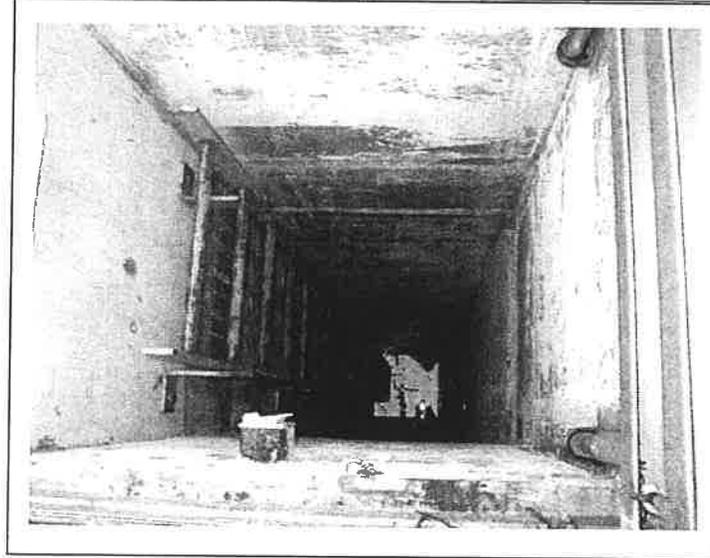
INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

Dam No. 1061

Date of Inspection October 19, 2011

Observations and Comments



View looking down access shaft to spillway box and pipe.

OWNER

STATE OF CALIFORNIA
CALIFORNIA NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone Dam No. 1061 County Los Angeles
Type of Dam Rectangular Concrete Tank Type of Spillway Concrete weir and pipe
Water is 11.7 E&W feet below spillway crest and 12.5 E&W feet below dam crest.
Gauge @ 615.5 E&W SAW Crest @ 627.2 Dam Crest @ 628.0
Weather Conditions Heavy rain
Contacts Made Jack Merluzzo with the City of Beverly Hills
Reason for Inspection Periodic Maintenance Inspection

Important Observations, Recommendations or Actions Taken

The valves were fully cycled during the inspection.

Conclusions

From the known information and visual inspection, the dam, reservoir, and the appurtenances are judged safe for continued use.

Observations and Comments

<u>Dam</u>	A parking lot is located on the roof of the covered reservoir. Walking down the stairs to the water level, the east and west sections appeared to remain in good condition. The water level was equal on both sides of the divided reservoir at Gauge reading 615.5 feet. The visible nearby columns, walls, and roof appeared to remain stable with no signs of distress or instability. The west side of the reservoir was empty during the January 22, 2008 inspection and thoroughly inspected and found to have no concerns to dam safety. The downstream slope and toe are nicely landscaped and remain in good condition.
<u>Spillway</u>	There is access to the spillway from a hatch near the southeast corner of the parking lot. The spillway is open and clear.
<u>Outlet</u>	The outlet consists of two upstream 18" inlet/outlet valves, two 12" drain valves, and a downstream 24" butterfly valve. The two 18" inlet/outlet valves were fully cycled during the inspection with no difficulties encountered. It took 41 turns to open each 18" valve from the full closed position to the full open position. The main delivery 24" valve was fully cycled 100% and remains in good operating condition. The 24" valve typically remains in the full open position. The two inlet valves near the access building that leads into the reservoir were also fully cycled during the inspection. All the valves are operated routinely for water demands.
<u>Seepage</u>	There were no signs of seepage detected on the downstream slope or toe of the dam. The heavy rain made everything wet. The three underdrains had no flow, which is normal.
<u>Instr.</u>	There is no instrumentation for this dam and none is judged necessary at this time.

Photos taken? Yes X No _____
cc for Owner/Book

Inspected by Joe Boyce 3/21/11
Date of Inspection 2/25/2011
Date of Report 3/16/2011

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

Dam No. 1061

Date of Inspection 3/16/2011



The inlet/outlet valves were fully cycled by hand.

STATE OF CALIFORNIA
CALIFORNIA NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone Dam No. 1061 County Los Angeles
Type of Dam Rectangular Concrete Tank Type of Spillway Concrete weir and pipe
Water is 12.8 E&W feet below spillway crest and 13.6 E&W feet below dam crest.
Weather Conditions Sunny and warm
Contacts Made Marcel Garrubba and Jack Merluzzo with the City of Beverly Hills
Reason for Inspection Periodic Maintenance Inspection

Important Observations, Recommendations or Actions Taken

All valves should be cycled in DSOD's presence during the next inspection.

Conclusions

From the known information and visual inspection, the dam, reservoir, and the appurtenances are judged safe for continued use.

Observations and Comments

<u>Dam</u>	A parking lot is located on the roof of the covered reservoir. The interior of the concrete tank was not thoroughly inspected because of the high reservoir level. Walking down the stairs to the water level, the east and west sections appeared to remain in good condition. The water level was equal on both sides of the divided reservoir. The visible nearby columns, walls, and roof appeared to remain stable with no signs of distress or instability. The west side of the reservoir was empty during the January 22, 2008 inspection and thoroughly inspected and found to have no concerns to dam safety. The downstream slope and toe are nicely landscaped.
<u>Spillway</u>	There is access to the spillway from a hatch near the southeast corner of the parking lot. The concrete that comprises the spillway remains structurally sound and in good condition. The spillway was open and clear.
<u>Outlet</u>	The outlet consists of two upstream 18" inlet/outlet valves, two 12" drain valves, and a downstream 24" valve. The two 18" inlet/outlet valves were fully cycled during the previous January 28, 2009 inspection with no difficulties encountered. It took 41 turns to open each 18" valve from the full closed position to the full open position. According to the log, all the valves were last cycled in September 2009. The west side valves were recently exercised on February 7, 2010 and the east side valves are anticipated to be exercised in July 2010.
<u>Seepage</u>	There were no signs of seepage detected on the downstream slope or toe of the dam. The three underdrains were dry, which is normal.
<u>Instr.</u>	There is no instrumentation for this dam and none is judged necessary at this time.

Photos taken? Yes X No _____
cc for Owner/Book

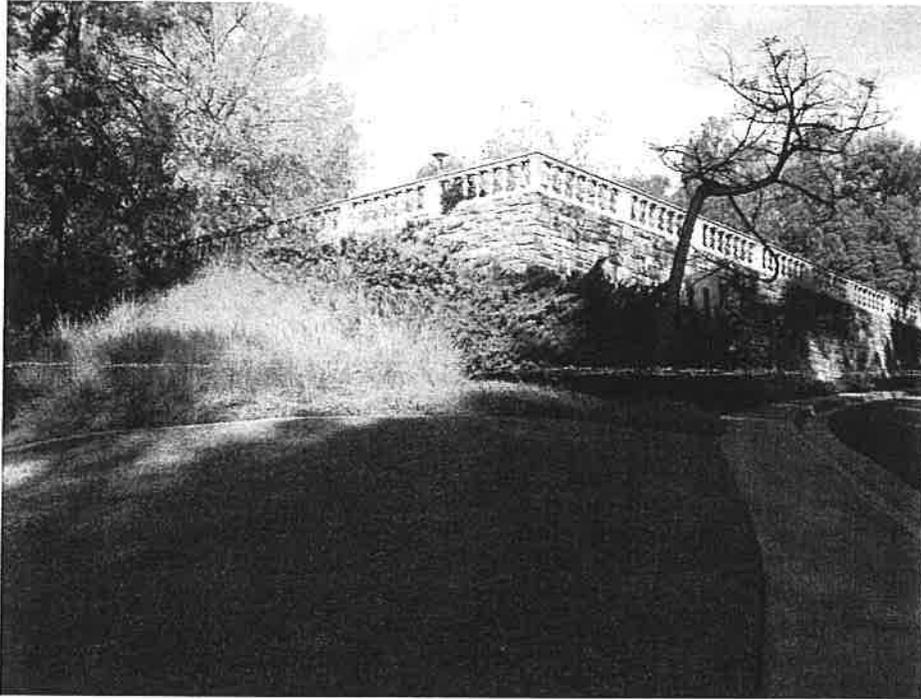
Inspected by Joe Boyce *3/3/10*
Date of Inspection 2/11/2010
Date of Report 2/23/2010 *3/3/10*

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam Greystone

Dam No. 1061

Date of Inspection 2/11/2010



The downstream southeast corner of the reservoir.



The spillway was clear.

owner

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam: Greystone Dam No: 1061 County: Los Angeles
Type of Dam: Rectangular concrete tank Type of Spillway: Concrete weir and pipe
Water is Empty W & 15.6 E feet below spillway crest and Empty W & 16.4 E feet below dam crest.
Gage 0 W & 612.9 E (above, below) (above, below)

Weather Conditions: Clear, mild, calm.
Contacts made: K. Watson. (Beverly Hills Dept of Public Works).
Reason for inspection: Periodic inspection

Important Observations, Recommendations, or Actions Taken
East I/O fully cycled during inspection.

Conclusions

From the known information and the visual inspection, the dam, reservoir, and appurtenances are judged satisfactory for continued use.

Observations and Comments

<u>Item</u>	<u>Observation and comment</u>
<u>Dam</u>	The crest and roof are a parking lot with minor cracking normally associated with asphaltic surfaces. The west side was empty and the entire interior walked. The concrete comprising the visible portion of the interior walls, floor slab, columns, and roof appeared to remain in satisfactory condition with no evidence of distress or instability. The visible floor joints appear well sealed and aligned. No evidence of distress or instability was noted. The visible portion of the east side appeared to remain in satisfactory condition.
<u>Spillway</u>	The approach was open and clear. The concrete comprising the weir and pipe remains in satisfactory condition.
<u>Outlet</u>	The outlet controls, operators, stems, and valves remain in satisfactory condition ^{and} the East I/O was fully cycled during the inspection with no difficulties. The east drain will be cycled in one month when that side is emptied for cleaning. The west drain was cycled a week ago when that side was emptied for cleaning. The west I/O will be cycled in ^e _A month when filling takes place.
<u>Seepage</u>	The embankment and groins were dry. The three underdrains were also dry.
<u>Instrum.</u>	There is no instrumentation for this dam and none is believed necessary at this time.

Typed by: RGD
Date: 02/15/08
cc for: owner


Inspection by: R. G. Draeger
Date of Inspection: 01/22/08
Date of report: 02/15/08
Photos take? Yes No

owner

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

INSPECTION OF DAM AND RESERVOIR IN CERTIFIED STATUS

Name of Dam: Greystone Dam No: 1061 County: Los Angeles
Type of Dam: Rectangular concrete tank Type of Spillway: Concrete weir and pipe
Water is 26.7 W & 27.7 E feet below spillway crest and 27.5 W & 28.5 E feet below dam crest.
Gage 601.3 W & 600.8 E (above, below) (above, below)

Weather Conditions: Clear, cool, calm.
Contacts made: K. Watson, M. Garrubba (Beverly Hills Dept of Public Works).
Reason for inspection: Periodic inspection

Important Observations, Recommendations, or Actions Taken

All four valves fully cycled during inspection.

Conclusions

From the known information and the visual inspection, the dam, reservoir, and appurtenances are judged satisfactory for continued use.

Observations and Comments

<u>Item</u>	<u>Observation and comment</u>
<u>Dam</u>	The crest and roof are a parking lot with minor cracking normally associated with asphaltic surfaces. The concrete comprising the visible portion of the interior walls, floor slab, columns, and roof appeared to remain in satisfactory condition with no evidence of distress or instability. The visible floor joints appear well sealed and aligned. I requested to be notified the next time the reservoir is taken out of service so that the interior could be completely inspected.
<u>Spillway</u>	The approach was open and clear. The concrete comprising the weir and pipe remains in satisfactory condition.
<u>Outlet</u>	The outlet controls, operators, stems, and valves remain in satisfactory condition and were fully cycled during the inspection with no difficulties. I suggested a log book be created to document the operations of the valves.
<u>Seepage</u>	The embankment and groins were dry. The three underdrains were also dry. The canyon underdrain was flowing about 2 gpm which is normal.
<u>Instrum.</u>	There is no instrumentation for this dam and none is believed necessary at this time.

Typed by: RGD
Date: 01/09/07
cc for: owner

Inspection by: R. G. Draeger
Date of Inspection: 01/03/07
Date of report: 01/09/07
Photos take? Yes No

R. G. Draeger

APPENDIX F: RESERVOIR ROOFTOP TOPOGRAPHIC SURVEY

