DEPARTMENT OF THE NAVY
MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA 94592

IN REPLY REFER TO:

5090
Ser 461.6/109

APR 1 1988

Ms. Lila Tang
San Francisco Bay Region
California Regional Water
Quality Control Board
1111 Jackson Street
Oakland, CA 94607

Dear Ms. Tang:

Pursuant to the California Regional Water Quality Control Board order No. 87-170, paragraph C.3.b., Mare Island Naval Shipyard has prepared an investigation of the minimum freeboard requirement for the Industrial Wastewater Treatment Plant surface impoundments.

The investigation showed that the 18 inch freeboard in the blending ponds is adequate for the containment of the maximum probable precipitation, the tidal and wave action generated by the maximum recorded wind for the last ten years.

Attached is a copy of the study and the calculations in support of the above conclusion. Any questions on these topics can be directed to Mr. Tony Lee, Environmental Engineer, Code 461.6, telephone number (707) 646-3375.

Sincerely,

W. J. Cornils

W. J. CORNILS
Head, Environmental-Energy
Management Division
By direction of the Shipyard Commander

Enclosure

Copy to:
United States Environmental Protection Agency
Region IX
Toxics and Waste Management Division, Code M-5
215 Fremont Street
San Francisco, CA 94105
Attention: Ms. Karen Scheuermann

California Department of Health Services
North Coast California Section
Toxic Substances Control Division
5850 Shellmound Drive, Suite 390
Emeryville, CA 94608
Attention: Mr. John O'Kane

Solano County Department of Public Health
601 Texas Street
Fairfield, CA 94533
Attention: Cliff Covey

Commander
Western Division, Naval Facilities
Engineering Command
Code 1142
P. O. Box 727
San Bruno, CA 94066
Attention: Mr. Dean Peterson

CALCULATIONS

3-16-88 AKL

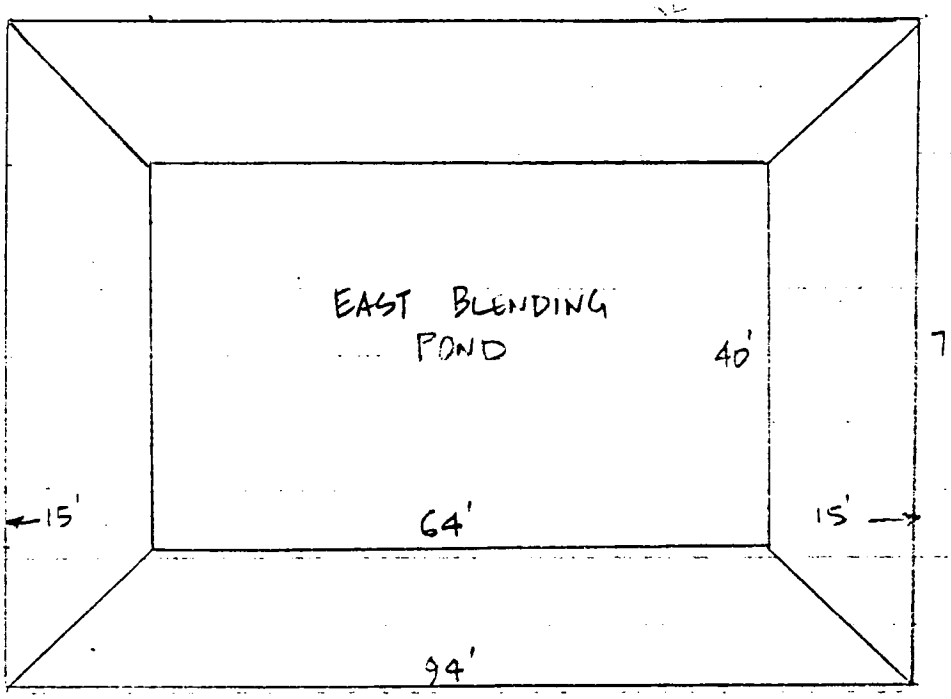
OBJ: EST. THE FREEBOARD REQM FOR THE IWTP EAST BLENDING POND

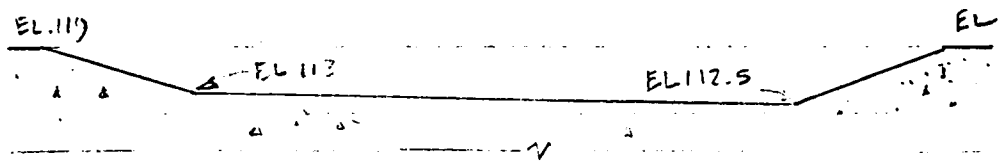
METHOD 1) CHECK FREEBOARD CAPACITY FOR HOLDING THE MAX PROBABLE PRECIP (TABLE 4.1, 23 CAC 2541); CLASS I WASTE MGMT. UNIT

2) IN ADDITION, CHECK WAVE HEIGHTS & WINDTIDES BASED ON WIND GENERATED WAVE & TIDE ACTIONS

BASIS: 1) MAX WIND SPEED = 60 KNOTS WESTERLY DIRECTION
(BASED ON WIND SPEED MEASUREMENTS FROM 1981 TO 1985) ≈ 69 MILES/HR

2) POND DIMENSIONS





3-16-88 AVL

1) EST. FREEBOARD CAPACITY OF POND

→ CAPACITY IF POND IS FILLED TO HIGHEST POINT (EL. 119)

= VOL. OF SLOPED SECTION + VOL. OF FLAT SECTION

$= (15' \times 6' \times 55') + (15' \times 6.5' \times 55') + (40' \times 64') \frac{6.5+6'}{2}$

$= 4950\ FT^3 + 5362\ FT^3 + 16,000\ FT^3$

$= 26,312\ FT^3 = \underline{196,810}$ GALLONS

PART B. APPLICATION SHOWS 206,600 GALLONS

CLOSE ENOUGH ≈ 5% DIFF.

→ CAPACITY IF POND IS FILLED TO CURRENT FREEBOARD LEVEL (EL 117.5)

$= (15' \times 4.5' \times 55') + (15' \times 5' \times 55') + (40' \times 64') \frac{4.5'+5'}{2}$

$= (3713 + 4125 + 12,160)\ FT^3$

$= 19,998\ FT^3 = \underline{149,580}$ GALLONS

→ CAPACITY ABOVE FREEBOARD LEVEL

$= 196,810 - 149,580 = \underline{47,230}$ GALLONS

3-16-88 AKL

THE MAXIMUM PROBABLE PRECIPITATION IN THE MINDY AREA IS A 100-YEAR, 24-HR DURATION STORM WITH RAINFALL OF 4.99 INCHES (BASED ON 105 YEARS OF RAINFALL RECORD, TABLE 5.1, HYDROLOGY AND DRAINAGE DESIGN PROCEDURE, COUNTY OF SOLANO, OCT. 1977)

THE VOLUME OF RAINFALL OVER THE POND AREA IS

$$\left(\frac{4.99''}{12} \times 70' \times 94'\right) = 2736\ FT^3 = 20,470\ \text{GALLONS}$$

2. THE VOLUME ABOVE THE FREEBOARD HAS APPROX. 2.3 TIMES THE NEEDED CAPACITY.

2) ESTIMATE WIND GENERATED WAVE

FROM THE "STANDARD HANDBOOK FOR CIVIL ENGINEERS", FREDERICK S. MERRIT, EDITOR, 1960, McGRAW HILL.
EQUATION 23-11 p. 23-7

WAVE HEIGHT IS RELATED TO WIND VELOCITY & FETCH AS FOLLOWS

$$H = 0.0555\, U F^{0.5}$$

H = SIGNIFICANT WAVE HT, FT
U = WIND VELOCITY, KNOTS
F = FETCH, NAUTICAL MILES

$$H = 0.0555 \left(60 \text{ KNOTS}\right)\left(\frac{94 \text{ FT. MILE}}{5280 \text{ FT}\,(1.15)}\right)^{0.5}$$

$$= 0.414 \text{ FT} = 5 \text{ INCHES}$$

3) EX. WIND TIDES

FROM THE "HANDBOOK OF HYDRAULICS" BY KING & BRATER, 5TH ED.
EQN. 10-87 & 10-88 DEVELOPED BY SIBUL:

$$\frac{h}{d} = 2.44 \times 10^{-5} \left(\frac{F}{d}\right)^{1.66} \left(\frac{U^2}{Fg}\right)^{a} \qquad \text{(EQN 10-87)}$$

$$a = 2.02 \left(\frac{F}{d}\right)^{-0.0768} \qquad \text{(EQN 10-88)}$$

WHERE h = INCREASE IN DEPTH OF WATER DUE TO WIND, FT.
d = DEPTH OF WATER, FT = 5 FT
F = WIND FETCH, FT = 94 FT
U = WIND SPEED, MILES/HR = 69 MPH
g = GRAVITATIONAL ACCELERATION FT/SEC^2 = 32.2 FT/SEC^2

$$a = 2.02 \left(\frac{94}{5}\right)^{-0.0768} = 1.612$$

$$\frac{h}{5} = 2.44 \times 10^{-5} \left(\frac{94}{5}\right)^{1.66} \left[\frac{\left(69 \frac{\text{miles}}{\text{HR}}\right)\left(5200 \frac{\text{FT}}{\text{mile}}\right)\left(\frac{\text{HR}}{3600 \text{ SEC}}\right)}{94(32.2)}\right]^{2} = 6.796$$

$h = 0.11$ FT $= \underline{\underline{1.3"}}$

WIND VELOCITY DATA FOR 1976 - 1986
AT MARE ISLAND NAVAL SHIPYARD

⇒ MAX WIND VELOCITY IN THIS PERIOD
= 60 KNOTS (1982)
~ 69 MPH

1965 ELEVATION - ~90'

		HIGHEST WIND VEL. (KNOTS)	DIRECTION
JAN		NO DATA	--
FEB	⇒	42	WSW
MAR.		56	NW
APR.		22	S, NW, NNW
MAY		23	WNW
JUN		24	NNE
JULY		21	S
AUG		20	WSW
SEPT		24	WNW
OCT		NO DATA	—
NOV.		NO DATA	—
DEC		NO DATA	—

1935 ELEVATION – 10.5 FT. QUAY WALL

	MAX WIND VELOCITY (KNOTS)	DIRECTION
JAN.	⇒ 55	E
FEB	35	ENE
MAR	45	ENE
APR	24	N, WSW
MAY	24	SSW, SW
JUN	22	SSE
JULY	22	WSW, WNW
AUG	23	W
SEPT.	22	W, WNW
OCT.	20	SSE
NOV.	19	W, WSW
DEC	16	W

1964 ELEVATION - ~ 90'

	MAX. WIND VELOCITY (MPH)	DIR. FROM
JAN	30	ENE
FEB	30	SSW
MAR	25	WNW
APR	29	W
MAY	35	N
JUN ⇒	50	SSW
JULY	NO DATA	-
AUG.	22	SSE, SSW
SEPT.	27	NW
OCT.	24	NNW
NOV.	25	S, SSE
DEC	25	E

1973 ELEVATION - ~ 90'

	MAX. WIND VELOCITY (KNOTS)	DIRECTION
JAN	25	E
FEB	30	S
MAR	24	W, S
APR	23	NNW
MAY	30	N, NNE
JUN	24	SSW
JULY	23	E
AUG	22	S
SEPT.	18	W
OCT.	18	ENE, WSW
NOV.	⇒ 35	SSE
DEC.	⇒ 35	W, WNW

1982 ELEVATION - ~ 90'

	MAX WIND VELOCITY (KNOTS)		DIRECTION
JAN	24		ESE
FEB ⇒	60	6%	N
MAR	25		SSW, SW, WSW
APR	30		WSW
MAY	23		WSW
JUN	NO DATA		
JULY ⇒	60		W
AUG	21		WNW, NNW
SEPT	23		N
OCT.	20		W
NOV.	35		W, S
DEC.	23		S

1961 ELEVATION - ~ 90'

	MAX. WIND VELOCITY (KNOTS)	DIRECTION
JAN	27	E
FEB	21	W
MAR	35	WSW
APR	22	W
MAY	30	W
JUN	23	W
JULY	24	S
AUG	20	S, WSW, W
SEPT.	21	S, WSW
OCT.	37	WNW
NOV.	⇒ 50	S
DEC.	27	E

1980

MONTH		MAX. WIND SPEED (KNOTS)	DIRECTION
JAN		23	N
FEB		25	NNE
MAR		25	N, NNE, W
APR		24	S, WNW, NW, NNW
MAY	⇒	56	ENE
JUN		24	SSW
JULY		22	SSW, W
AUG		22	WSW
SEPT		17	S, SSW
OCT.		17	W
NOV.		23	ESE
DEC		24	ESE, SSE

TYPE OF OBSERVATION: HOURLY
TOTAL OBSERVATIONS = 7960

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* METEOROLOGICAL RECORDS FOR THE PERIOD *
* BEGINNING 1/ 1/79 *
* ENDING 12/31/79 *
****

LATITUDE: 28 25' 55.13"
LONGITUDE: 122 16' 32.13"

FOR THE YEAR OF 1979

*** WIND DATA ***

DIRECTION	VELOCITY (KNOTS) MAXIMUM	AVERAGE	FREQUENCY BY NUMBER	PERCENT
N	30.	4.4	1083	13.6
NNE	15.	3.3	53	0.7
NE	15.	6.4	45	0.6
ENE	16.	4.6	121	1.5
E	18.	5.5	547	6.9
ESE	22.	6.5	302	3.8
SE	17.	5.8	138	1.7
SSE	21.	5.3	169	2.1
S	22.	6.4	551	6.9
SSW	22.	8.9	834	10.5
SW	23.	8.4	794	10.0
WSW	24.	8.5	1447	18.2
W	24.	8.7	1407	17.7
WNW	17.	5.2	264	3.3
NW	18.	4.8	72	0.9
NNW	23.	5.9	133	1.7

CALM WIND

NUMBER	PERCENT
266	3.3

*** TEMPERATURE (FAHRENHEIT) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
102.	35.	63.1	7960

*** HUMIDITY (PERCENT) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
98.	28.	73.6	7960

*** BAROMETRIC PRESSURE (INCH HG) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
30.99	28.95	30.16	7960

*** WEATHER CONDITIONS *** (PERCENT)

CLEAR	PARTLY CLOUDY	CLOUDY	NO. READINGS
54.4	22.0	23.7	7643

END OF FILE 9999

1978

MONTH		MAX. WIND SPEED (KNOTS)	DIRECTION
JAN		22	N, S, SSW, SW
FEB		16	WNW
MAR		21	S, SSW, SW, W
APR		22	WSW
MAY		NA	—
JUN		21	WSW, W, WNW
JULY		NA	—
AUG	⇒	24	S
SEPT.	⇒	24	S, W
OCT.		NA	—
NOV		18	N, NW
DEC		NA	—

TYPE OF OBSERVATION: HOURLY
TOTAL OBSERVATIONS = 7056

METEOROLOGICAL RECORDS FOR THE PERIOD
BEGINNING 1/ 1/77
ENDING 12/31/77

LATITUDE: 28 25' 55.13"
LONGITUDE: 122 16' 32.13"

FOR THE YEAR OF 1977

*** WIND DATA ***

DIRECTION	VELOCITY (KNOTS) MAXIMUM	VELOCITY (KNOTS) AVERAGE	FREQUENCY BY NUMBER	FREQUENCY BY PERCENT
N	20.	4.6	240	3.4
NNE	18.	6.5	55	0.8
NE	18.	3.6	161	2.3
ENE	13.	5.5	68	1.0
E	21.	6.6	395	5.6
ESE	19.	6.4	246	3.5
SE	16.	5.0	498	7.1
SSE	18.	5.4	49	0.7
S	24.	6.0	174	2.5
SSW	21.	6.9	171	2.4
SW	25.	8.0	774	11.0
WSW	46.	8.4	1568	22.2
W	23.	7.0	1329	18.8
WNW	23.	6.6	806	11.4
NW	20.	5.2	424	6.0
NNW	17.	4.8	98	1.4

CALM WIND

NUMBER	PERCENT
260	3.7

*** TEMPERATURE (FAHRENHEIT) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
102.	39.	64.0	7056

*** HUMIDITY (PERCENT) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
97.	20.	69.8	7056

*** BAROMETRIC PRESSURE (INCH HG) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
30.98	27.00	30.22	7056

*** WEATHER CONDITIONS *** (PERCENT)

CLEAR	PARTLY CLOUDY	CLOUDY	NO. READINGS
71.8	15.4	12.8	6311

END OF FILE 9999

AV...B
MARE ISLAND WEATHER REPORT SUMMARY
STATISTICS

DATE 01/11/77 PAGE 1

TYPE OF OBSERVATION: HOURLY
TOTAL OBSERVATIONS = 8577

METEOROLOGICAL RECORDS FOR THE PERIOD
BEGINNING 1/ 1/76
ENDING 12/31/76

LATITUDE: 28 25' 55.13"
LONGITUDE: 122 16' 32.13"

FOR THE YEAR OF 1976

*** WIND DATA ***

DIRECTION	VELOCITY (KNOTS) MAXIMUM	VELOCITY (KNOTS) AVERAGE	FREQUENCY BY NUMBER	FREQUENCY BY PERCENT
N	24.	3.8	229	2.7
NNE	19.	4.5	99	1.2
NE	22.	7.2	403	4.7
ENE	18.	4.5	68	0.8
E	25.	4.8	391	4.6
ESE	16.	5.3	274	3.2
SE	18.	3.9	685	8.0
SSE	12.	3.3	80	0.9
S	16.	2.8	145	1.7
SSW	20.	5.0	78	0.9
SW	22.	6.9	880	10.3
WSW	27.	7.8	2081	24.3
W	22.	6.4	1421	16.6
WNW	20.	6.2	1220	14.2
NW	29.	4.4	478	5.5
NNW	11.	3.3	51	0.6

CALM WIND

NUMBER	PERCENT
653	7.6

*** TEMPERATURE (FAHRENHEIT) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
105.	5.	64.8	8577

*** HUMIDITY (PERCENT) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
100.	17.	70.3	8577

*** BAROMETRIC PRESSURE (INCH HG) ***

MAXIMUM	MINIMUM	AVERAGE	NO. READINGS
31.42	29.00	30.24	8577

*** WEATHER CONDITIONS *** (PERCENT)

CLEAR	PARTLY CLOUDY	CLOUDY	NO. READINGS
71.4	15.6	13.0	7971

A17

FREEBOARD

IWTP SURFACE IMPOUNDMENTS FREEBOARD REQUIREMENTS STUDY

BACKGROUND

California Regional Water Quality Control Board (RWQCB) order no. 87-170 of December 21, 1987 requires MINS to comply with section 2548 of subchapter 15 of Title 23 CAC, or demonstrate that a minimum freeboard of less than 2 feet is adequate to prevent overtopping of the IWTP surface impoundments. Section 2548a of subchapter 15 of Title 23 CAC required that surface impoundments shall have sufficient freeboard to accomodate seasonal precipitation and precipitation conditions specified for each class of waste management unit in table 4.1 of the same article, but in no case less than 2 feet and shall be designed and constructed to prevent overtopping as a result of wind conditions likely to accompany such precipitation conditions. The IWTP surface impoundments are considered by the RWQCB for the purpose of the waste discharge requirements to be class I waste management units and as such they must be designed for maximum probable precipitation.

METHODOLOGY

The present IWTP surface impoundments are operated with an 18-inch freeboard in the blending ponds. The adequacy of the 18-inch freeboard will be investigated base on the following probable conditions:

o Increased capacity requirement due to rainfall from a maximum probable precipitation;

o Increased liquid height due to wave action generated by the maximum recorded wind speed (wind speed data from 1976 to 1986);

o Increased liquid height due to tidal action generated by the maximum recorded wind speed (wind speed data from 1976 to 1986).

Overtopping of the blending pond containment will be investigated for all three conditions.

STUDY RESULTS

(see attached calculations for details)

CASE 1 - MAXIMUM PROBABLE PRECIPITATION

The estimated volume available in the 18-inch freeboard section of the ponds is 47,200 gallons. The maximum probable precipitation volume based on a 24-hr 100 year storm is 20,500 gallons. Therefore each blending pond has more than twice the required volume to handle the maximum probable precipitaion.

CASE 2 - WAVE ACTION GENERATED BY THE MAXIMUM RECORDED WIND SPEED

The maximum recorded wind speed for the period from 1976 to 1986 is 60 knots (69 miles per hour). Based on this speed and equation 23 - 11 for wind generated wave, (from the Standard Handbook for Civil Engineers, Frederich S. Merrit, Editor) the wave height is estimated to be 5 inches. This is still within the 18-inch operating freeboard of the blending ponds.

CASE 3 - TIDAL ACTION GENERATED BY THE MAXIMUM RECORDED WIND SPEED

The maximum recorded wind speed for the period from 1976 to 1986 is 60 knots (69 miles per hour). Based on this speed and the Sibul correlation for wind generated tidal action, the estimated increase in the still liquid height is 1.3 inches. This will not present any overtopping problem with the 18-inch operating freeboard of the blending ponds.

CONCLUSIONS

The IWTP blending ponds with the current 18-inch operating freeboard will have no problem accomodating the maximum probable precipitaion or the windtide and wind wave generated by the maximum recorded wind speed for the years 1976 to 1986.