BUILDING A WORLD OF DIFFERENCE®

BLACK & VEATCH

Water Quality Modeling of the Las Vegas Wash

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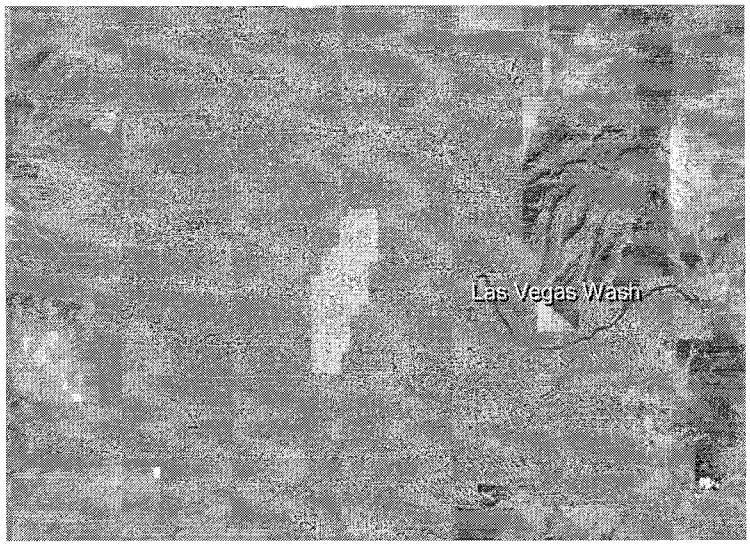
Outline

- Background
- LV Wash Model
- Model Assumptions
- Methodology and Calibration
- Results
- Summary

See page 9 for TDS.

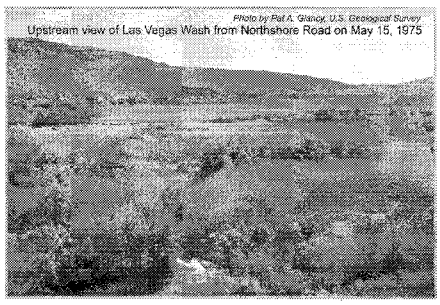
Background



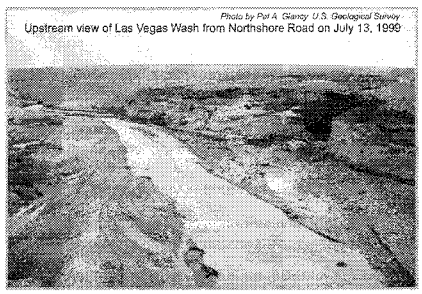
Background (cont.)

- Las Vegas has been discharging to the LV Wash since 1955
- Clean Water Coalition formed in 2002
- Systems Conveyance and Operations Program (SCOP)
  - Alternate Discharge
  - Wash Protection
  - Help Protect Water Quality for Southern Nevada

Background (cont.)

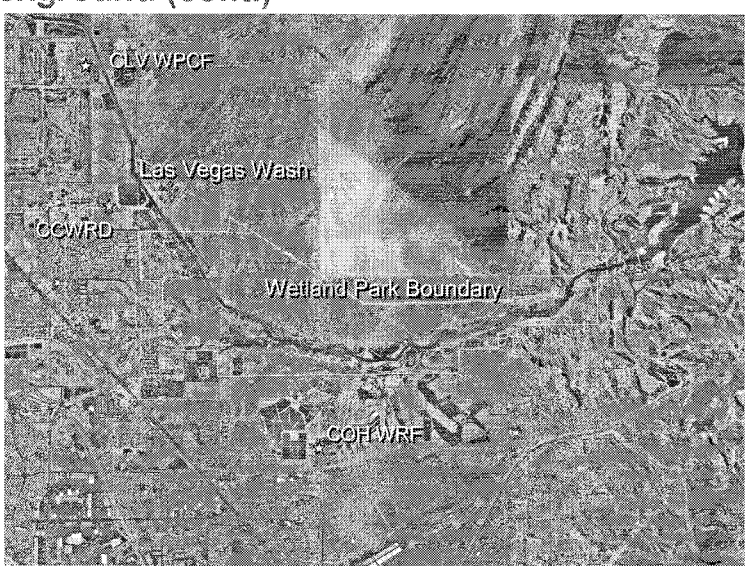


LV Wash in 1975

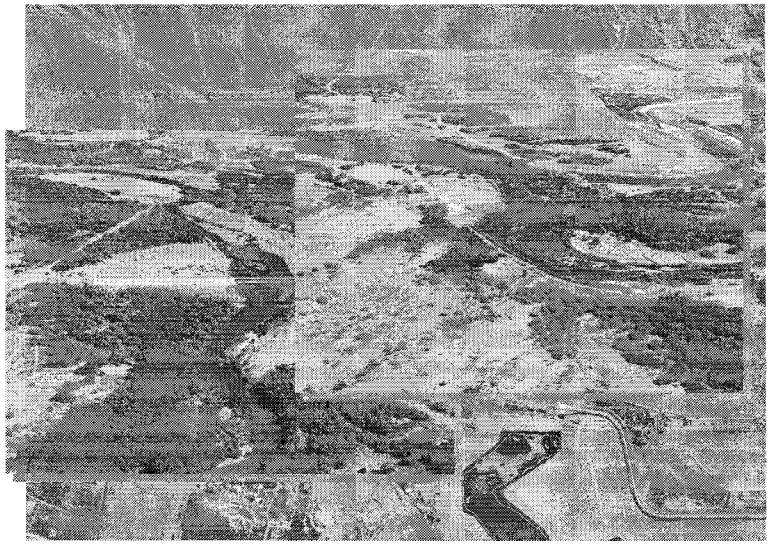


LV Wash in 1999

Background (cont.)



Background (cont.)



Model Assumptions

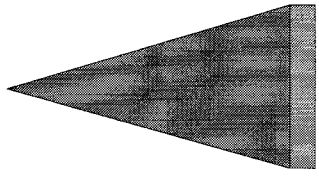
- Pollutant loading from precipitation and atmosphere is negligible
- The removal or loss of pollutants due to evapotranspiration is negligible
- The rate of percolation out of the wetlands is negligible
- The removal of Total Dissolved Solids (TDS) by biological or sedimentation mechanisms is negligible

Model Assumptions (cont.)

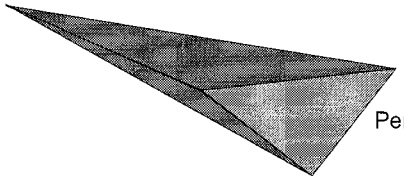
- Total Kjeldahl Nitrogen (TKN) entering the wetland would be converted to ammonia
- If water is removed for irrigation, it is removed at the weir so pollutant concentrations would be the same as the wetland effluent

Methodology and Calibration

Wetland Configuration

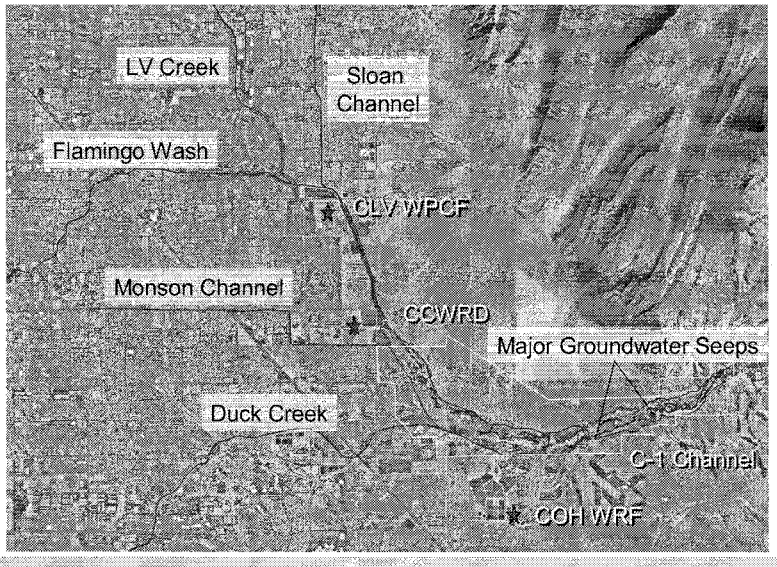


Top View



Perspective View

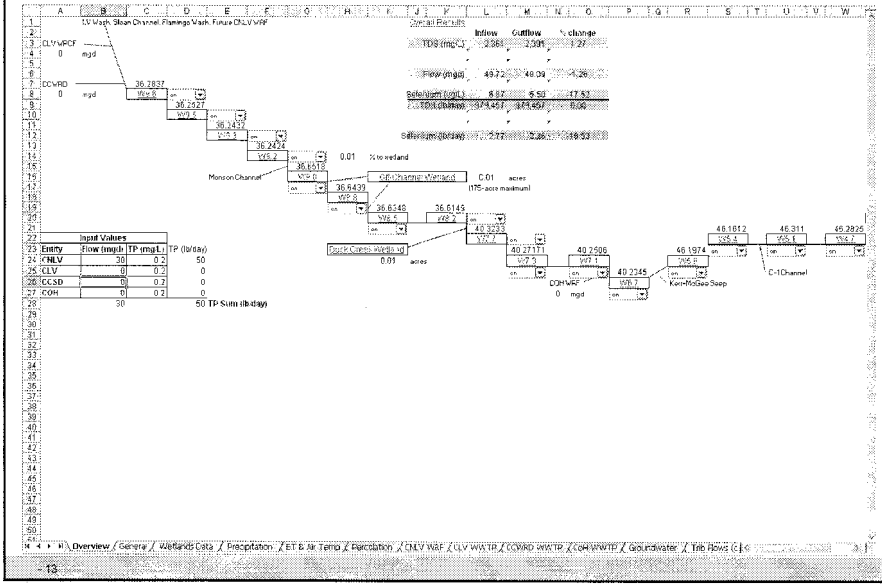
Methodology and Calibration (cont.)



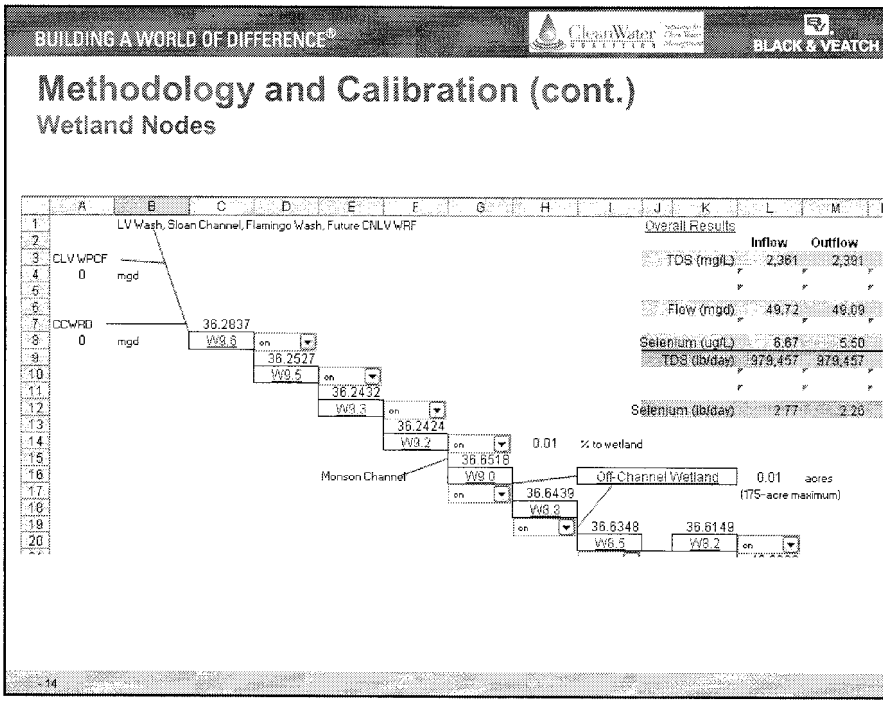
Methodology and Calibration (cont.)

Modeled Parameters

- Flow
- Temperature
- Total Inorganic Nitrogen (TIN)
- Total Phosphorus (TP)
- Selenium
- Total Dissolved Solids (TDS)



Methodology and Calibration (cont.)



Methodology and Calibration (cont.)

Wetland Nodes

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Methodology and Calibration (cont.)

Data Sheet

Notes

1 No tributary data was available during model development; therefore, the following assumptions were made:

A Total tributary flow is 10% of the total flow from the 3 WWTPs

B Total tributary flow is split evenly among the 8 individual tributaries.

C Tributary water temperature is the same as the air temperature.

D Tributary water quality is as indicated below

Month	Flow (mgd)						Temperature (deg C)						CBOD (mg/l)					
	1997	1998	1999	2000	2001	Average	1997	1998	1999	2000	2001	Average	1997	1998	1999	2000	2001	Average
January	[illegible]	[illegible]	2.52	[illegible]	4.81	4.1	?	?	?	?	5	9.0	?	?	?	?	50	50.00
February	[illegible]	?	2.22	?	4.81	3.7	?	?	?	?	[illegible]	14.2	?	?	?	?	50	50.00
March	3.15	11.05	3.66	5.17	4.81	5.6	?	?	?	?	[illegible]	19.3	?	?	?	?	50	50.00
April	4.33	5.34	5.51	3.65	5.45	5.0	?	?	?	?	24.5	24.5	?	?	?	?	50	50.00
May	[illegible]	4.23	3.54	3.30	4.55	4.1	?	?	?	?	[illegible]	25.3	?	?	?	?	50	50.00
June	4.29	[illegible]	[illegible]	[illegible]	[illegible]	4.0	?	?	?	?	[illegible]	26.0	?	?	?	?	50	50.00
July	5.58	[illegible]	?	4.52	4.81	6.4	?	?	?	?	[illegible]	26.8	?	?	?	?	50	50.00
August	[illegible]	[illegible]	5.04	[illegible]	4.58	5.6	?	?	?	?	22.0333	22.8	?	?	?	?	50	50.00
September	?	12.41	[illegible]	[illegible]	4.60	7.2	[illegible]	?	?	?	[illegible]	19.7	?	?	?	?	50	50.00
October	[illegible]	[illegible]	5.96	?	4.81	5.5	?	?	?	20.7	[illegible]	17.0	?	?	?	?	50	50.00
November	[illegible]	[illegible]	4.83	?	4.81	5.3	?	?	?	?	[illegible]	12.9	?	?	?	?	50	50.00
December	3.57	[illegible]	[illegible]	?	4.81	4.2	?	?	?	?	[illegible]	11.0	?	?	?	?	50	50.00

Month	TKN						NO2 + NO3 (mg/l as N)						TP					
	1997	1998	1999	2000	2001	Average	1997	1998	1999	2000	2001	Average	1997	1998	1999	2000	2001	Average
January	?	?	?	?	0.1	0.10	?	?	?	?	[illegible]	6.13	?	?	?	?	[illegible]	0.03
February	?	?	?	?	0.1	0.10	?	?	?	?	4.525	4.53	?	?	?	?	[illegible]	0.02
March	?	?	?	?	0.1	0.10	?	?	?	?	4.525	4.53	?	?	?	?	[illegible]	0.02
April	?	?	?	?	0.1	0.10	?	?	?	?	[illegible]	3.94	?	?	?	?	0.01	0.01
May	?	?	?	?	0.1	0.10	?	?	?	?	4.525	4.53	?	?	?	?	0.01725	0.02
June	?	?	?	?	0.1	0.10	?	?	?	?	4.525	4.53	?	?	?	?	0.01725	0.02
July	?	?	?	?	0.1	0.10	?	?	?	?	3.61	3.61	?	?	?	?	0.01	0.01
August	?	?	?	?	0.1	0.10	?	?	?	?	4.525	4.53	?	?	?	?	[illegible]	0.02
September	[illegible]	?	?	?	0.1	0.65	?	?	?	?	4.525	4.53	0.05	?	?	?	[illegible]	0.03
October	?	?	?	0.7	0.1	0.40	?	?	?	[illegible]	[illegible]	2.67	?	?	?	[illegible]	[illegible]	0.06
November	?	?	?	?	0.1	0.10	?	?	?	?	4.525	4.53	?	?	?	?	[illegible]	0.02
December	?	?	?	?	0.1	0.10	?	?	?	?	4.525	4.53	?	?	?	?	[illegible]	0.02

Month	TSS						TDS						Selenium (ug/L)					
	1997	1998	1999	2000	2001	Average	2001	2002	2003	2004	2005	Average	2001	2002	2003	2004	2005	Average
January	?	?	?	?	80	80.00	3470	3410	3200	3240	2310	3,126	?	17.5	15.2	?	13.4	15.37
February	?	?	?	?	80	80.00	?	?	?	?	3,011	3,011	?	14.53	?	?	?	14.53
March	?	?	?	?	80	80.00	?	?	?	?	3,011	3,011	?	14.53	?	?	?	14.53
April	?	?	?	?	80	80.00	3010	3000	2910	3100	3090	3,022	?	15.7	14.8	?	16.2	15.90
May	?	?	?	?	80	80.00	?	?	?	?	3,011	3,011	?	14.53	?	?	?	14.53
June	?	?	?	?	80	80.00	?	?	?	?	3,011	3,011	?	14.53	?	?	?	14.53
July	?	?	?	?	80	80.00	3250	3060	3140	2980	2910	3,068	?	14.4	?	13.6	13.2	13.73
August	?	?	?	?	80	80.00	?	?	?	?	3,011	3,011	?	14.53	?	?	?	14.53
September	?	?	?	?	80	80.00	?	?	?	?	3,011	3,011	?	14.53	?	?	?	14.53
October	?	?	?	?	80	80.00	3400	3200	3210	3070	1260	2,828	?	14.4	15.6	15	6.3	13.13
November	?	?	?	?	80	80.00	?	?	?	?	3,011	3,011	?	14.53	?	?	?	14.53
December	?	?	?	?	80	80.00	?	?	?	?	3,011	3,011	?	14.53	?	?	?	14.53

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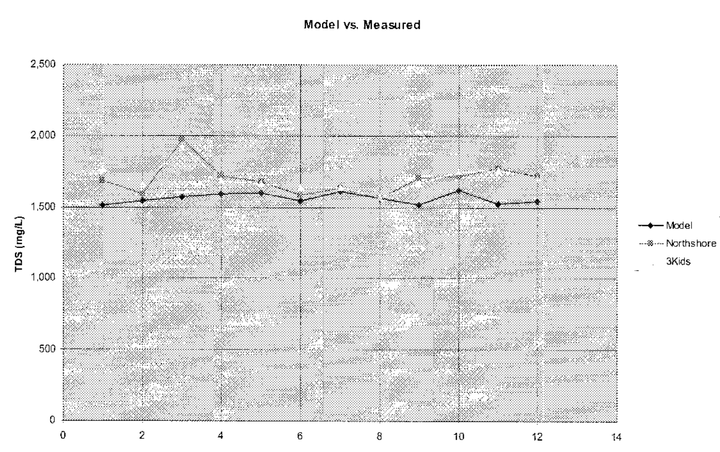
Methodology and Calibration (cont.)



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Results

Month	Flow (mgd)	TIN (mg/L)	TP (mg/L)	TDS (mg/L)	Temp (°C)	Selenium (µg/L)
Jan	17.9	6.1	0.04	4,179	10.4	8.1
Feb	19.4	5.8	0.06	4,323	11.5	6.8
Mar	19.4	6.0	0.04	4,460	16.3	7.3
Apr	18.7	5.9	0.02	4,453	20.2	8.6
May	18.2	6.5	0.04	4,703	25.6	6.9
Jun	17.2	6.7	0.04	4,704	28.2	6.6
Jul	20.3	5.7	0.03	4,618	28.6	7.9
Aug	21.8	5.6	0.33	4,102	27.8	6.7
Sep	22.2	5.8	0.12	3,754	25.0	7.6
Oct	18.1	4.9	0.07	4,887	20.2	7.4
Nov	18.9	6.0	0.04	4,201	14.0	7.2
Dec	16.9	6.1	0.04	4,417	10.8	6.6
AVG	**19.1**	**5.9**	**0.07**	**4,400**	**20.0**	**7.3**

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Results (cont.)

Scenario	Flow (mgd)	TIN (mg/L)	TP (mg/L)	TDS (mg/L)	Temp (°C)	Selenium (µg/L)
No Effluent	19.1	5.9	0.07	4,400	20.0	7.3
30 mgd Effluent	49.1	10.5	0.1	2,416	20.0	5.6
80 mgd Effluent	99.1	12.0	0.2	1,785	20.5	5.0
170 mgd Effluent	189.1	12.7	0.2	1,490	21.0	4.7
300 mgd Effluent	319.1	12.8	0.2	1,361	21.0	4.6
400 mgd Effluent	419.1	12.8	0.2	1,316	21.0	4.5

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Summary

- Model created in Microsoft Excel to simulate 22 planned wetlands and water quality changes
- Calibrated against data downstream of modeled section and found to be fairly accurate
- Model is a potentially powerful tool in creating operation plan for future flows in the Las Vegas Wash through the SCOP project

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Methodology and Calibration (cont.)