In response to the spills into Buena Vista Lagoon, efforts were undertaken to mitigate spill damage and document impacts of the discharge on the lagoon environment. Staff of the Cities of Carlsbad and Vista, laboratory staff of the Encina Wastewater Authority, and the consulting firms of Weston Solutions, Inc., and Merkel & Associates, Inc, undertook these efforts. Field sampling was intended to monitor the spread of wastewater, provide information on bacterial levels for purposes of analyzing human health exposure risks, and to assess impacts on the lagoon ecosystem. The purpose of this document is to describe the environmental response actions taken during and after the spill incident, document the monitoring work performed, summarize monitoring results, and describe the environmental damage based on present information. Material and data presented in this review are to be considered preliminary and reflect the best available information at the time of document preparation. Further data collection and analysis are ongoing and may alter conclusions presented at this time.

METHODS

ENVIRONMENTAL RESPONSE PROGRAM

The environmental response efforts that have been undertaken include in-system diversion of wastewater flows, overflow pump-out and waste collection, lagoon aeration, lagoon/wastewater pump-back, as well as erosion control and stabilization of the pipeline repair site. Future actions planned to be undertaken to mitigate adverse effects of the spill and emergency response include revegetation of the work areas, and fence repairs where emergency access was facilitated. The methods for performing this work are described here.

In-System Waste Diversions

Upon determining the source of the leak to be the Buena Vista Force Main, the City of Oceanside was contacted by the City of Carlsbad and requested to divert sewage coming into the system to the greatest extent possible. On April 1, Oceanside was able to divert approximately 800-1,000 GPM from the Vista/Carlsbad line upstream of the Buena Vista Force Main. These system diversion actions would ultimately result in removal of 2.085 million gallons of wastewater from the spill volume.

Overflow Pump-out and Waste Collection

Atlas Pumping trucks was hired by the City of Carlsbad to deliver four 5,500-gallon-capacity trucks to the site in order to recover some of the spill and begin shipping sewage to other collection systems. This activity occurred full-time beginning on April 3, while the wastewater level rose within the lift station containment area and spilled over the berm crest. In addition, vactor trucks from Carlsbad, Vista, Oceanside, and Encinitas were used to collect and transport sewage to other lines. The total volume of sewage diverted through this effort is estimated to be approximately 669,000 gallons. This waste was fed back into the Encina Wastewater Authority's collection system and therefore is not a factor in the total spill volume calculation, but rather represents sewage diverted from the spill prior to release to the lagoon.

Lagoon Aeration

Aeration in the immediate spill area began on the afternoon of April 2, during the active spill. Aeration was intended to prevent an extreme drop in dissolved oxygen (DO) to reduce stress or mortality in resident fauna. Following installation of the first aerator, three more were introduced on April 3, with a total of six installed and operating by April 7. Aeration was achieved using both 6-inch recirculating water pumps that sprayed above the lagoon and splashed into the lagoon waters, as well as submerged aerators operating through the release of compressed air through perforated air lines. Aerators were distributed in the immediate area of the spill throughout the upper end of the east basin and within the southernmost channel around the upper basin islands. Bubble aerators were set approximately 18 inches below the water surface on stands. Pumps and compressors were operated 24 hours per day from the time aeration started to shutdown, except during minor periods when pumps needed to be replaced.

Pump-Back Operations

At approximately 1700 hours on April 3, following repairs of the force main, a 6-inch pump started drawing wastewater and water back from the lagoon following the Encina Wastewater Authority Sanitary Sewer Overflow Response Plan (Encina Wastewater Authority 2003). A second pump was added to the drawback at 2000 hours. This effort served two functions. The first and immediate effort was to extract wastewater from the lagoon. The second was to reverse the flow gradient within the lagoon and draw the waste plume back towards the point of origin and away from the lower lagoon. Through this pumping effort, water was drawn from the lagoon to the Buena Vista Pump Station at a rate of approximately 3,000 gallons per minute and routed to the Encina Wastewater Authority treatment plant through the Buena Vista Force Main. After bacteria levels declined and DO substantially recovered, the pump rate was reduced on April 11 to approximately 1,500 gallons per minute in an effort to balance the rate of creek inflow (approximately 1,170 gallons per minute). This reduced pump-back continued until April 16 at 1600 hrs. Pumps were operated 24-hours per day. Through the 13 days of pumping, approximately 42.3 million gallons were pumped back from the lagoon and diverted to the sanitary sewer system.

Erosion Control

Following repairs of the pipeline, clean soils were imported to reconstruct the failure area and bank that had been removed at the line break and highline tie-in excavation pits. These areas were subsequently stabilized with temporary erosion control measures including fiber roles and fiber mats in accordance with City of Carlsbad requirements. Erosion control BMPs inspection was performed by City of Carlsbad Construction Dept. inspectors on April 6. Corrective actions were required and completed the same day. A second inspection was performed on April 6 to close out corrective actions.

Revegetation of Damaged Area and Fencing Repairs

In the coming weeks, the Cities will work with the California Department of Fish & Game (CDFG) to identify restoration requirements for damaged areas where excavations and equipment staging occurred. It is anticipated that these areas will be planted with container plants and hand seeded with additional cover vegetation since they are fairly

small. Supplemental watering will be required until plants are established. In addition to this restoration work, a fence was taken down to provide access for equipment along the north side of the lagoon along South Vista Way. This fence will be repaired and the slope where vehicles accessed the edge of the lagoon will be restored.

WATER QUALITY MONITORING

Water quality monitoring was performed at stations spread throughout the lagoon. Most of the monitoring stations were established during prior spill events of 1994 and 1997 (MEC Analytical Systems 1994, 1997). In addition to established monitoring stations, supplemental stations were incorporated as conditions dictated under the present spill situation. Figure 2 illustrates the monitoring stations used and referred to in this document.

Bacterial Monitoring

Bacterial monitoring consisted of tests for total coliform (S.M. 9222B), fecal coliform (S.M. 9222D), and enterococcus (S.M. 9230C). Sampling was initiated on April 2 by the Encina Wastewater Authority's (EWA) laboratory staff. Samples were collected using a pole and sterile sample jars. The jar was extended away from shore and submerged in an inverted position to a depth of approximately 6 inches where it was then turned over and allowed to fill. The sample was then removed from the water and capped. Samples were processed by EWA (E.L.A.P. Certification No. 1441). Stations monitored within the lagoon were BV1-6 on April 2, BV1-8 on April 3-5, and BV 1-9 from April 6 to the 14th. Stations were also outside the lagoon in the Pacific Ocean. Stations 1S-4S and 1N-6N were sampled on April 2-4. Stations were then reduced to 1S, 2S, 1N, and 2N on April 5-9 and reduced again to 1S and 1N on April 10 and 11. Sampling was then discontinued at the oceanic stations. After April 13th, bacterial samples were collected by Merkel & Associates staff and provided to the EWA laboratory for analysis. Sample results were provided directly to San Diego County Department of Environmental Health (DEH) for use in evaluation of beach and lagoon postings.

Dissolved Oxygen

Dissolved oxygen (DO) monitoring was initiated on the afternoon of April 2. DO serves as a proxy for bacterial concentration through measurement of bacterial respiration. Bacteria consume oxygen and respire carbon dioxide. Therefore low DO levels may indicate high bacterial concentration. Stations for DO analysis were categorized as shoreline lagoon-wide stations (BV 1-8), east basin stations (101-109 and 10), middle basin stations (10A-G). Beginning April 3, stations were monitored for DO twice daily: in the morning and afternoon.

Weston Solutions, Inc. performed DO measurements using a YSI 6600 or similar multiparameter meter following guidelines established in the Standard Methods for the Examination of Water and Wastewater, 19th Edition (SM 4500 O G). Shoreline monitoring performed by City Environmental Programs staff and Merkel & Associates employed a YSI 55 DO meter. A Hydrolab Datasonde 5 multiprobe was used for DO sampling at offshore stations after April 11th. DO calibrations were performed

N W E S

Water Quality Monitoring Stations
Buena Vista Sewer Force Main Discharge
April 2007

Figure 2

following the meter manufacturer's recommendations. If more than one meter was used during an event, side-by-side comparisons were used to ensure readings were within an acceptable range of accuracy.

The San Diego Basin Plan water quality objective for DO for inland waters with WARM and BIOL beneficial uses is 5.0 mg/l. Values below 3.0 mg/l may result in fish kills. DO measurements were performed at depths just below the surface for waters less than 2 feet. When sample depths were greater than two feet, DO measurements were performed at just below the surface, middle, and just above the bottom depths. Care was taken to ensure that sample probes were not immersed in the bottom sediments and that readings between depths were allowed time to stabilize. After April 8, all DO monitoring duties were assumed by Merkel & Associates, Inc. and were performed in a similar manner with a YSI 600XL deployed from a small boat and a YSI 55 DO meter from shore.

RESOURCE IMPACT ASSESSMENT

Dead Organism Collections

Surveys of the entire lagoon were made for collection of dead or dying organisms between April 3 and 14. All dead fish were found between April 3 and 7, with the exception of a few that had clearly succumbed days earlier. Dead birds were found between April 5 and 7. Fish and bird collections were performed principally by Weston Solutions, Inc. However, assistance with collections was also provided by staff of the Cities of Carlsbad, Oceanside, and Vista, as well as Merkel & Associates, Inc. Samples were identified, counted, and, in the case of fish, measured by Weston and the data recorded in the field on datasheets and later compiled in an electronic format at a table and figure.

Benthic Infauna

Benthic infaunal sampling was conducted on April 4 and April 5, 2007 in the east, central, and west basins of the lagoon at the stations indicated in Figure 3. Open water benthic invertebrate samples were collected from three locations within each of the three basins using a standard 0.025-m^2 Eckman grab sampling device. A small inflatable boat powered by an electric motor was used in deploying the grab sampler. Station coordinates, water depth, and other pertinent information such as sediment type, color, odor, and amount of algal/grass cover in the sample were recorded. At each site location, the Eckman sampler was deployed and pushed into the sediment via a sampling pole for maximum penetration. Successfully collected samples were brought aboard the sampling vessel, emptied into a clean 3-gallon bucket, and thoroughly mixed by hand using a stainless steel spoon. One sample was collected at each sampling location. After the material from a given site location was homogenized in the 3-gallon bucket, the sediment was mixed with site water and passed through a 0.5-mm sieve using site water. Material and organisms retained on the sieve were transferred to sample jars, labeled with the site information, and preserved in a 1:10 mixture of formalin and site water. At the end of each day, the preserved samples were transported in labeled coolers to Weston Solutions, Inc. in Carlsbad, CA for storage. Upon arriving at Weston Solutions, Inc. the formalin in

each of the sample jars was decanted off, the samples were rinsed, and then subsequently preserved in their original containers in a 70 percent ethanol solution.

Sampling took place within five days of the beginning of wastewater entry into the lagoon. If infauna were impacted by the spill, many would have been dead by the time of sampling although there would not have been time for significant decay of the organisms' tissues. Therefore, animals that may have been dead will be analyzed and counted as having been alive. These post-spill samples represent baseline data to which post-impact samples will be compared. Post-impact samples have not yet been collected. Collections will be made after sufficient time has passed to allow decay of tissues in animals killed by conditions resulting from the spill, so that a spill impact may be detected. Collections should not, however, occur after recovery of the system has begun. An appropriate period for collection will be May 2007.

HABITAT LOSS ASSESSMENT

On April 13, 2007, Merkel & Associates, Inc. conducted a field survey to identify and quantify all habitat impact areas associated with the completion of emergency pipeline repairs. Each area where habitat impacts had occurred was documented, with habitat type identified and the area of impact quantified by measurement of area.

Baseline Benthic Sampling Stations
Buena Vista Sewer Force Main Discharge
April 2007

Figure 3

Merkel & Associates, Inc.

RESULTS

WATER QUALITY STATUS OVER TIME

Bacteriological Monitoring

Table 1 provides the summary of bacterial monitoring data collected during and following the 2007 spill event. For presentation ease, recorded counts of total coliform, fecal coliform, and enterococcus (TFE) bacterial groups are presented in sequential graphs and figures depicting levels of bacteria at eight key stations from April 2 to 14 in Appendix A1.

Human health standards for total coliform require bacterial cell counts of less than 10,000 per 100 ml. On April 2, three of the four stations near the spill (BV1-4) exhibited cell counts in the range of 1 to 5 million cells per 100 ml: well above health standards. Similar conditions persisted until April 6. One of those four stations exhibited cell counts in that range on April 6 and 7, after which counts in this range did not occur. Total coliform was not measured at the juncture between the east and central basins, under the I-5, on April 2. However, total coliform sampled at two stations in that location (BV7 and 8) beginning April 3 exhibited cell counts above the health standard through April 5. Counts above the standard were not seen in the western portions of the lagoon. Counts near the spill source dropped below the health standard on April 13, although one of the four stations returned to a potentially hazardous condition on April 14 (Table 1).

Human health standards for fecal coliform require that cell counts be below 400 per 100 ml. Beginning April 2, two of four stations near the spill source exhibited counts in the 1 to 5 million range and all were well above standard. Counts were also above the standard at the I-5 bridge stations (BV7 and 8) until April 6. In the spill area, one station on the east side of the Jefferson Street bridge fell into the 100-1,000 cells per 100 ml range on April 5. This station and the I-5 bridge stations remained in the acceptable range following April 5. Stations in the spill area continued to improve throughout the monitoring period, but did not all fall within an acceptable range before monitoring was terminated. It should be noted that other inputs for fecal coliform were evident in the lagoon. The western stations, un-impacted by the spill, periodically exhibited elevated fecal coliform counts.

The human health standard for enterococcus requires cell counts below 104 per 100 ml. Beginning April 2, three of four stations near the spill source exhibited cell counts in the 1 to 5 million range and this condition persisted until April 5. The I-5 bridge stations did not fall into non-hazard range until April 6. As with fecal coliform, enterococcus first fell within standards at the station east of Jefferson Street (above the spill). All stations within the spill area did not meet the health standard before April 14, although the degradation curve for enterococcus suggested that levels would be achieved by about April 16.

Table 1 - Summary of Bacteriological Testing Data at Buena Vista Lagoon (April 2-14, 2007)
Encina Waterwater Authority Laboratory Analyses

Total Coliform*

	4/2/2007	4/3/2007	4/4/2007	4/5/2007	4/6/2007	4/7/2007	4/8/2007	4/9/2007	4/10/2007	4/11/2007	4/12/2007	4/13/2007	4/14/2007
BV01	3,800	8,300	5,700	3,300	1,900	3,400	2,600	5,600	2,200	6,600	4,300	3,600	3,300
BV02	1,820,000	970,000	1,010,000	4,170,000	1,520,000	830,000	360,000	130,000	50,000	25,000	30,000	7,000	14,000
BV03	2,460,000	1,900,000	1,250,000	3,280,000	820,000	720,000	290,000	120,000	52,000	41,000	28,000	5,000	5,000
BV04	2,120,000	2,080,000	1,140,000	1,970,000	930,000	1,170,000	260,000	80,000	26,000	28,000	13,000	3,000	4,000
BV05	3,000	900	1,300	500	100	600	400	300	200	300	300	400	300
BV06	6,950	3,800	700	1,600	900	400	300	7,600	400	500	200	1,100	600
BV07		199,500	20,000	31,400	3,200	1,400	200	4,200	400	300	300	800	500
BV08		112,500	40,000	32,400	3,600	1,200	600	3,100	200	400	600	500	200
BV09					1,100	1,000	800	2,800	3,300	1,800	400	300	500

Fecal Coliform*

	4/2/2007	4/3/2007	4/4/2007	4/5/2007	4/6/2007	4/7/2007	4/8/2007	4/9/2007	4/10/2007	4/11/2007	4/12/2007	4/13/2007	4/14/2007
BV01	1,200	2,300	2,700	1,000	300	1,000	1,300	200	200	1,300	300	1,500	900
BV02	2,350,000	670,000	890,000	1,380,000	460,000	380,000	20,000	14,000	1,000	5,000	6,600	3,200	2,000
BV03	2,300,000	980,000	900,000	1,030,000	360,000	120,000	100,000	10,000	4,000	9,600	3,000	2,000	1,200
BV04	2,280,000	1,820,000	840,000	370,000	300,000	190,000	100,000	8,000	1,000	5,200	2,600	2,600	600
BV05	100	200	100	200	200	100	100	50	50	100	100	50	50
BV06	100	800	100	200	200	200	400	1,050	100	100	250	50	150
BV07		95,500	10,000	11,200	1,000	700	50	50	50	50	200	450	100
BV08		36,500	10,000	5,800	1,000	100	1,050	50	50	300	100	350	50
BV09					700	100	200	800	100	250	50	50	200

Enterococcus*

	4/2/2007	4/3/2007	4/4/2007	4/5/2007	4/6/2007	4/7/2007	4/8/2007	4/9/2007	4/10/2007	4/11/2007	4/12/2007	4/13/2007	4/14/2007
BV01	200	300	300	100	200	200	100	1,000	600	900	100	100	100
BV02	482,000	116,000	110,000	116,000	22,000	8,000	3,000	3,000	2,400	1,200	1,200	200	1,200
BV03	438,500	112,000	118,000	122,000	22,000	6,000	3,000	2,000	1,400	5,200	1,400	1,200	200
BV04	421,500	118,000	126,000	118,000	36,000	4,000	1,000	2,000	2,000	2,000	400	400	600
BV05	100	100	100	100	100	100	50	50	50	50	50	50	50
BV06	100	100	100	400	100	100	100	100	50	50	100	50	50
BV07		1,000	2,000	200	100	600	50	50	50	50	50	100	50
BV08		1,000	2,000	200	100	100	50	50	50	50	50	50	50
BV09					100	100	50	100	50	50	50	50	50

**Values reported as less than a specific value in testing dilutions have been identified in this summary table as the value for purposes of numeric analyses.*

Dissolved Oxygen

Station monitoring data for dissolved oxygen are presented in Table 2. The summary chart below presents the mean of the data each day with the stations grouped into East Stations (BV2, BV3, BV4, 6, 7, 8, 9, 10, 4, 5, 104, and 105), I-5 Stations (1, 2, 3, 101, 102, 103, BV7, BV8, 10D, 10E, 10F, and 10G), 101 Stations (BV5, 10A, 10B, 10C), and the Weir Station at the mouth of the lagoon (single data point each day).

Measurement of DO at approximately 30 stations each day in the morning and afternoon allowed the production of detailed contours in DO concentration throughout the lagoon (Appendix A2). This mapping began on April 3 and continues presently. From DO contour maps produced following the spill, it was determined that the maximum extent of a detectable plume covered approximately 50.4 acres (203,891 m^2), representing 41% of the total 122.6 acres (496,438-m^2) of open water in the lagoon. The area principally influenced by this spill was calculated to cover approximately 71.6% or 27.5 acres (111,334 m^2) of the total 38.4 acres (155,612 m^2) of open water in the east basin and 22.4% of the total lagoon open water habitat.

The focus should be on DO concentration data from the morning sampling as opposed to the afternoon. Morning DO levels will be used for primary analyses while afternoon levels provide additional information. Afternoon DO levels are influenced by oxygen production through photosynthesis occurring throughout the day until the time of sampling. Therefore these measurements may not reflect bacterial respiration accurately and are skewed by the amount of sunlight and photosynthesizing plant material in the area. Morning DO levels reflect a greater influence from bacterial respiration after several hours of interruption in photosynthesis.

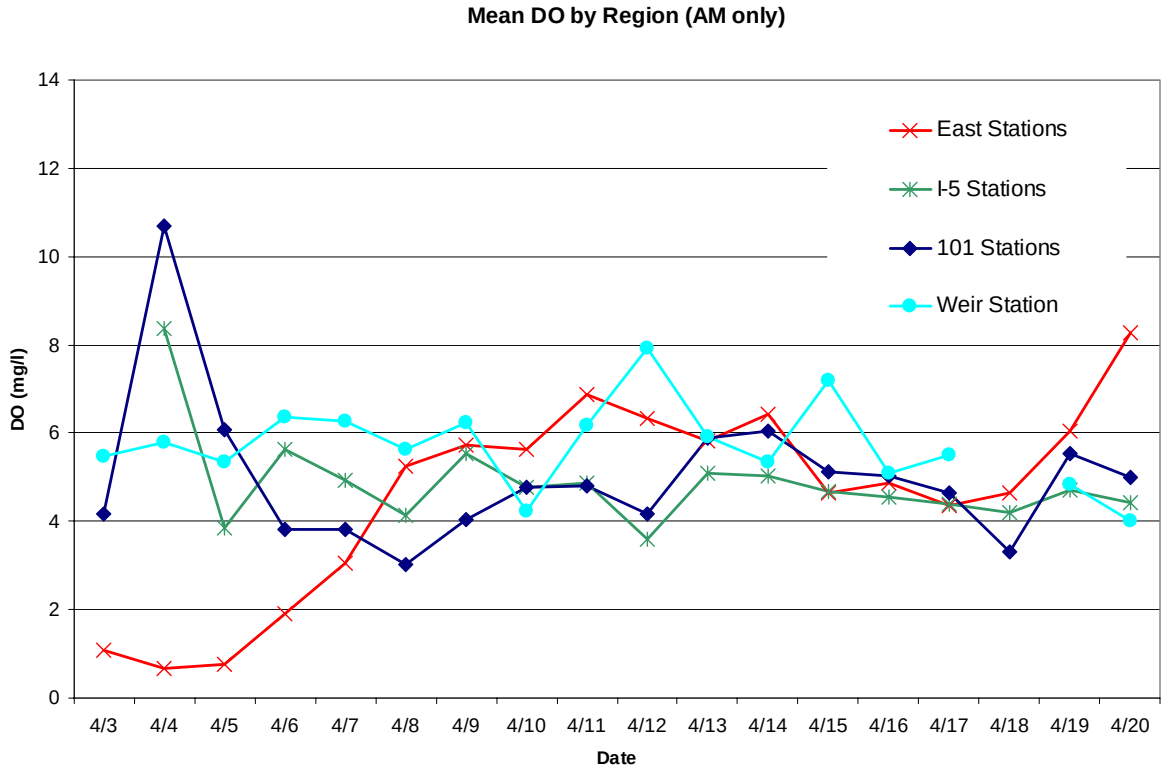


Table 2 - Summary of Dissolved Oxygen Monitoring at Buena Vista Lagoon (April 2-20, 2007)

STATION ID	TYPE	Dissolved Oxygen Concentration (mg/l)																									
		04/02/07	04/03/07		04/04/07		04/05/07		04/06/07		04/07/07		04/08/07		04/09/07		04/10/07		04/11/07	04/12/07	04/13/07	04/14/07	04/15/07	4/16/2007	4/17/2007	4/18/2007	4/19/2007	4/20/2007
		PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	AM	AM	AM	AM	AM	AM	AM	AM	AM
BV01	SHORELINE		4.27			5.11	3.81	5.78	5.00	6.56	1.08	3.98	3.07	5.32	3.27	6.11	3.59	6.97	4.16	4.89	4.28	4.46	4.31	4.04	3.97	*	3.78	2.91
BV02	SHORELINE		1.75			1.37	1.68	1.35	0.99	4.73	2.55	4.33	3.11	4.95	3.36	8.98	3.23	11.03	5.19	5.43	4.87	5.44	4.15	3.40	3.81	*	4.35	5.77
BV03	SHORELINE		1.50			0.93	1.39	1.90	1.98	4.50	0.93	7.83	2.85	9.07	4.42	20.00	3.35	20.00	5.67	6.36	5.71	6.21	5.06	3.43	3.70	*	4.96	5.40
BV04	SHORELINE		1.55			1.22	1.12	1.76	0.50	0.98	0.82	4.34	3.68	7.71	3.37	11.88	3.62	16.70	5.41	5.60	5.43	6.50	4.21	3.81	4.61	*	5.84	7.62
BV05	SHORELINE	5.14	4.18		4.57		4.14	6.50	3.75	6.13	3.21	4.97	2.63	4.42	3.08	9.15	3.58	8.96	4.25	4.62	5.55	5.07	5.02	4.60	4.62	*	5.12	3.19
BV06	SHORELINE	5.92	5.48		5.80		5.36	6.04	6.35	*	6.26	7.56	5.63	8.74	6.24	9.18	4.23	10.02	6.18	7.92	5.92	5.34	7.19	5.10	5.49	*	4.85	4.01
BV07	SHORELINE			4.24	4.41		5.14	6.59	3.60	6.03	2.22	2.63	1.64	3.47	2.80	6.08	2.58	5.95	3.42	2.23	2.36	2.51	3.38	2.84	3.71	*	2.63	2.62
BV08	SHORELINE			4.45	5.92		5.06	7.31	3.70	6.40	2.35	4.03	1.97	4.12	2.77	6.52	2.64	6.48	2.94	3.23	2.45	2.85	3.46	2.61	2.77	*	2.78	2.47
10A	LAGOON			6.13	11.28	12.39	5.25	6.44	3.47	5.14	3.34	3.11	2.51	4.28	3.93	7.01	4.98	6.40	4.62	3.30	5.92	5.75	4.50	5.19	4.54	3.08	5.47	4.64
10B	LAGOON			7.26	12.80	14.88	8.82	7.23	4.28	6.27	4.86	5.44	3.90	7.45	5.15	8.73	5.77	8.19	5.55	4.55	6.17	7.19	5.28	6.40	5.59	3.56	6.55	6.43
10C	LAGOON			7.23	14.07																5.91	6.21	5.71	3.87	3.83	3.28	4.96	5.75
10D	LAGOON			7.00	12.87	15.06	3.58	7.58	5.82	6.70	3.28	5.45	2.99	7.40	5.51	9.24	3.85	8.12	4.47	3.89	6.04	6.72	6.33	5.05	4.96	5.11	5.75	6.07
10E	LAGOON			7.38	14.76	15.57	5.25	7.38	6.72	6.58	4.87	5.73	4.85	7.71	6.84	10.30	6.19	8.62	6.82	5.48	6.29	6.92	6.57	6.93	7.57	6.67	7.10	6.56
10F	LAGOON			7.53	13.38	17.91	9.41	9.27	6.88	7.46	4.38	6.23	3.61	8.69	6.25	10.53	5.59	10.53	6.42	5.73	5.85	6.02	6.06	6.43	5.97	5.78	6.82	5.22
10G	LAGOON			6.73	13.16	18.18	2.44	7.80	6.03	6.46	3.66	5.60	2.73	6.98	5.16	8.20	5.20	9.24	4.39	2.64	5.21	6.08	5.92	6.10	5.71	5.17	5.68	4.36
1	LAGOON			3.71	2.42																							
2	LAGOON			7.84	5.43																							
3	LAGOON			7.55	2.91																							
4	LAGOON			1.22	0.75																							
5	LAGOON			1.04	0.82																							
6	LAGOON			0.31	1.41																							
7	LAGOON			0.34	0.44																							
8	LAGOON			0.56	0.08																							
9	LAGOON			0.36	0.43																							
10	LAGOON		0.73	0.73	0.85																							
101	LAGOON					11.30	1.31	2.65	7.07	10.04	8.16	15.72	10.33	13.55	9.94	21.34	6.06	19.82	6.37	3.55	5.29	5.28	3.92	3.35	3.00	0.82	4.13	6.23
102	LAGOON					15.78	0.80	3.79	5.04	10.67	7.09	22.43	4.08	6.79	6.79	25.00	5.28	18.12	5.73	2.48	7.21	4.59	3.20	3.69	2.88	1.67	3.86	3.27
103	LAGOON					20.61	1.69	4.72	5.89	16.10	8.40	18.91	4.93	16.43	3.82	24.50	5.54	10.16	3.14	3.04	*	4.15	3.39	3.97	2.94	*	3.73	2.90
104	LAGOON					7.61	1.08	0.07	5.64	11.47	8.89	8.43	10.97	16.41	9.74	26.00	11.38	28.30	14.45	11.83	7.25	7.56	4.58	7.58	4.55	4.88	7.05	10.06
105	LAGOON					0.79	0.48	0.04	4.61	11.07	8.56	9.42	10.74	16.69	8.80	23.98	8.86	23.05	8.41	6.18	6.82	7.67	5.73	7.27	4.35	4.10	6.36	9.60
106	LAGOON					0.37	0.24	0.09	0.92	0.40	1.76	11.35	4.12	14.54	8.50	17.62	5.26	20.67	5.17	6.35	5.35	5.91	5.73	4.10	4.26	4.40	6.38	9.56
107	LAGOON		0.34			0.62	0.35	0.02	1.23	0.08	1.23	3.62	3.57	6.29	4.11	10.73	4.84	10.02	5.61	4.87	5.18	6.20	4.09	4.24	4.58	4.66	6.60	8.90
108	LAGOON		0.56			0.37	0.30	0.04	0.92	5.12	1.48	5.44	4.28	6.85	4.90	13.20	5.08	12.04	6.42	5.16	5.80	6.36	4.16	4.10	4.54	4.75	6.65	11.05
109	LAGOON					0.15	0.29	0.02	0.26	0.25	1.20	3.95	3.94	6.64	4.43	11.43	5.06	12.03	5.47	5.33	6.12	6.08	4.16	5.83	4.71	5.00	6.21	6.57

* Denotes probe failure, calibration failure, or data loss due to field sampling issue.
Blanks indiate sampling was not performed at station during the sampling period.

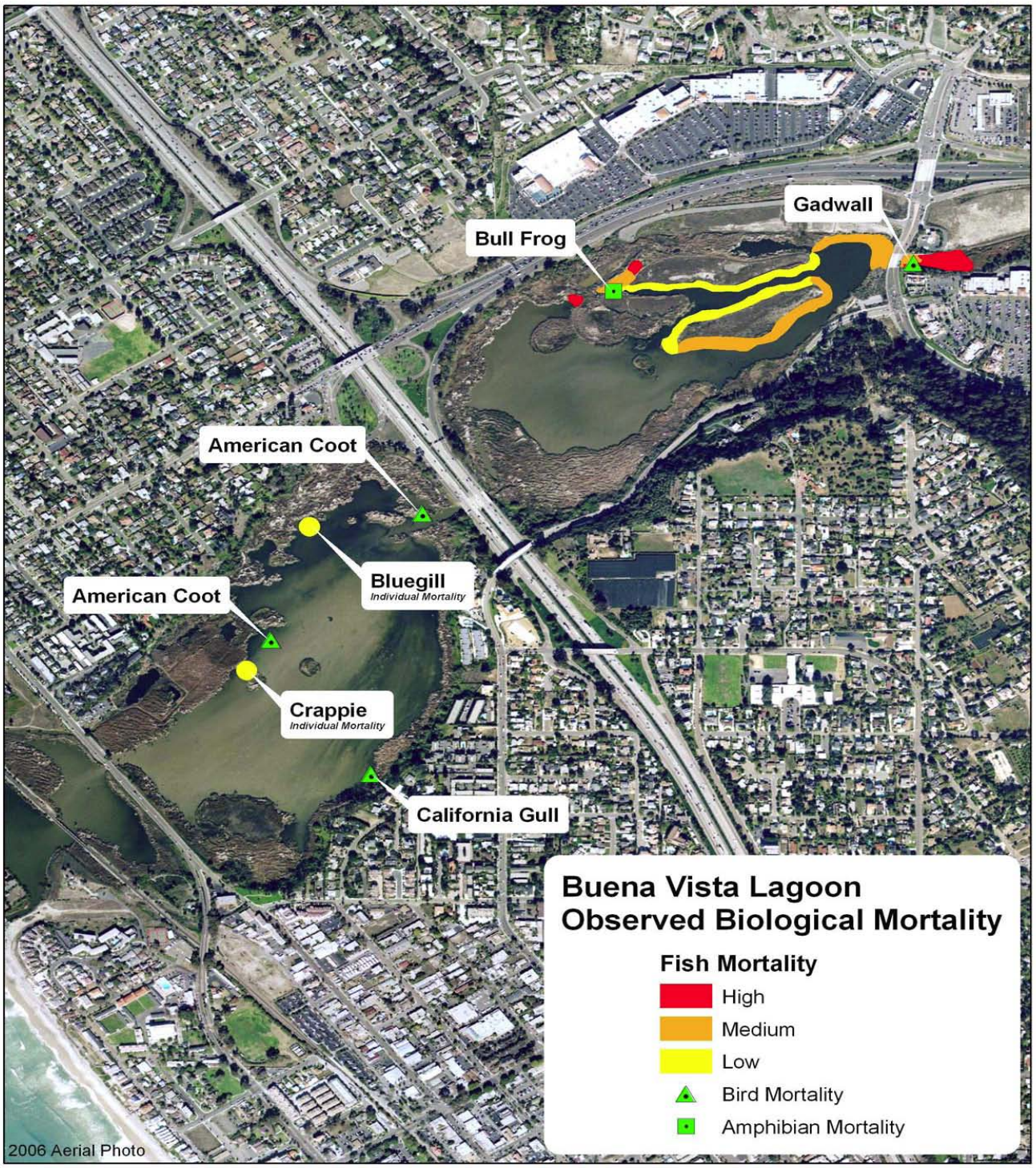
RESOURCE IMPACTS

Fish Mortality

The locations and amount of fish mortality can be compared with the pattern of DO concentration in the lagoon. The majority if not all fish mortality likely occurred immediately after significant amounts of wastewater were spilled. At that time, fish would not have been able to seek refuges of high DO while a majority of the east basin was low in DO. An adequate number of monitoring locations were first sampled on the morning of April 4, allowing a great enough level of detail to produce a map of DO concentrations that likely approximated reality. Although DO measurements were taken on April 3, the low number and spread of sample stations created large distances of extrapolation between points and probably an inaccurate reflection of DO across the lagoon. Therefore we assume that the initial spread of low DO in the lagoon likely covered a greater area than was mapped on the morning of April 4, but was more localized than is reflected in the map of DO created from data taken on April 3.

On the morning of April 4, 72% or 111,334 m^2 of a total area of 155,612 m^2 in the east basin showed DO values less than 3.0 mg/l. According to the San Diego Basin Plan, DO values below 3.0 mg/l may result in fish kills. Fish mortality appears to have occurred primarily in the eastern portions of the east basin (Figure 4).

No dead fish were recovered on the south shoreline of the east basin but rather were recorded primarily on the northern shoreline and around the island in the center of the basin. Fish likely expired around the center of the spill location and moved northward by the wind. A total of two dead fish were found on the northern shoreline of the central basin, indicating that low DO water encroached into the middle basin enough to have a minor impact on fish there, or it is possible that these fish had drifted from the east basin. The vast majority of the 1,694 fish (99.9%) were recovered in the east basin.



Buena Vista Sewer Force Main Discharge
Faunal Mortlity-
Collection Locations

Figure 4

Merkel & Associates, Inc.

Fish mortality was significantly lower during present spill than the previous spill in 1994, despite the total volume released during the 1994 spill less than the current event (Table 1). In 1994 4.75 million gallons were released in comparison to 7.3 million gallons released in the current event. It is possible that decreased fish mortality can be attributed to swift action in the remediation efforts. Pump-back of the contaminated water as well as aeration may have decreased the severity of spill impacts.

Table 3. Faunal Mortality, 2007 and 1994 Spill Events, and DO Tolerances

Species	Known Dissolved Oxygen Tolerance*	Mortality (no.)	
		1994	2007
Largemouth Bass	>1.5-2.0 mg/l	835	187
Bluegill	<1 mg/l	1671	648
Black Crappie		279	5
Channel Catfish	1-2 mg/l	70 lbs.	0
Bullhead	1-2 mg/l	348	604
Carp	0.5-3 mg/l	278	36
Mosquitofish	near 0 mg/l	3,000+	1+
Green Sunfish	<3 mg/l	0	210
Carp – Goldfish	O_2 deficient water	0	3
Birds		0	4
Bullfrog		0	1
Freshwater Shrimp		320,000	0
Crayfish		9,600	3

*McGinnis 1984 and Moyle 1976

Avian Mortality

A total of four dead birds were found during surveys for impacts to avian species. These included one California gull (*Laurus californica*), two American coots (*Fulica Americana*), and one gadwall (*Anas strepera*).

Amphibian Losses

A single bullfrog was collected from the east basin during the recovery efforts (Figure 4).

Invertebrate Losses

Epibenthic Macrofauna

A total of three crayfish were collected from the lagoon. Two were collected from the east basin near the Jefferson Street bridge. The third was collected at the weir in a 75% decomposed condition and likely was unrelated to the spill. Notably, no freshwater shrimp were found during the present spill even though these crustaceans constituted the majority of the loss following the 1994 spill.

Benthic Infauna

Analysis of spill impacts to benthic infauna is not yet possible as post-spill sample collection must be delayed until the natural decay of killed animal's tissues allows for the detection of an effect. Comparisons will then be drawn between samples collected immediately post-spill and approximately one month post-spill. Samples may also be compared to other recently collected benthic infaunal data, reported in the Buena Vista Lagoon Land Management Plan Elements prepared in 2000 and data from the San Diego County Municipal CoPermittees Urban Runoff Monitoring Annual Reports for the Ambient Bay and Lagoon Monitoring Program for 2003 and 2004 (MEC 2004, 2006).

VEGETATED WILDLIFE HABITAT IMPACTS

Table 4 presents impacts to vegetated wildlife habitat related to the spill response. Non-wetland upland habitat was removed from the wildlife viewing area and at an entry point where a fence was taken down to access the north side of the lagoon from South Vista Way. Wetland habitat impacts are predominantly temporary in nature and have resulted from establishing pumping and aeration sites at existing clearings. These losses have been due to trampling by response crew labor.

Table 4 - Impacts Resulting From the Emergency Response

HABITAT	AREA (SQ. FT.)
Disturbed Atriplex/Isocoma Scrub	9,292
Disturbed Exotic Vegetation	378
Non-tidal Alkali Marsh	350
Freshwater Marsh	152
TOTAL	**10,172**

The principal losses occurred within the actual repair area in a location that has been a restoration site by CDFG. As a result, it is contemplated that the restoration of this damaged area will be coordinated with CDFG with the intent of rapid recovery to a state comparable to the conditions prior to the spill event. Wetlands (freshwater and alkali marsh) that have been damaged have generally been damaged by driving pumps into place at clearings made by fishing activities and damaging minor fringes of wetlands at these areas. Additional damage has occurred in an area where CDFG has previously cleared cattail marsh at the wildlife viewing area. Young cattails have been damaged by trampling in this clearing as a result of biological monitoring activities to access boats. In all cases where the wetland damage has occurred, it is expected that viable rootstock will allow for rapid recovery of the trampled vegetation.

Restoration of the damaged native upland habitat may require up to three years to achieving the maturity of prior vegetation in this area. The damaged wetlands are expected to recover by the end of the 2007 summer season through natural plant regeneration of remaining live rootstock.

COMPARISONS TO PAST SPILL EVENTS

Investigations of data collected following the April 2007 spill are aided by examining the results of the 2007 spill in conjunction with the 1994 and 1997 spills. The Jefferson Street pump station underwent a major upgrade in 1993, before any of the three most recent spills. Fully prescribed spill response plans were not yet in place before the first spill in 1994. Although pump-back of spilled wastewater was performed following all three events, efforts were commenced most promptly in 1997 than in 1994, following just one day. Pump-back did not commence in 2007 until 2.5 days following the initial release, due to the time it took to accomplish pipeline repairs. Despite this, other efforts following the present event, such as aeration, may have mitigated the spill effects and prevented greater environmental harm.

Table 5. Spill Event Comparisons

	Spill Event		
Spill Date	**August 1994**	**February 1997**	**April 2007**
Spill Volume (million gallons)	4.75	1.75	7.33
Pump-back Volume (million gallons)		4.7	42.30
Avian Mortality	0	0	4
Fish Mortality	6,446	0	1,694
Amphibian Mortality	0	0	1
Macroinvertebrate Mortality	329,600	0	4

Several key factors in the past three spill events can be considered when assessing differences in the impacts of these three spill events. The season in which each spill occurred is likely the greatest determinant of ultimate lowest observed dissolved oxygen levels. Water is capable of carrying greater amounts of oxygen in solution when at lower temperatures. Therefore, a spill event in the summer when water temperatures are higher could be expected to produce lower dissolved oxygen levels and therefore increased severity in impacts to fauna. This, in fact, can be observed in the three recent events (Table 5). Although the August 1994 spill released a lower volume of wastewater than the 2007 event, the highest mortality of fish and invertebrates resulted from that event. Significantly higher temperatures would have been observed in August than in either February or April.

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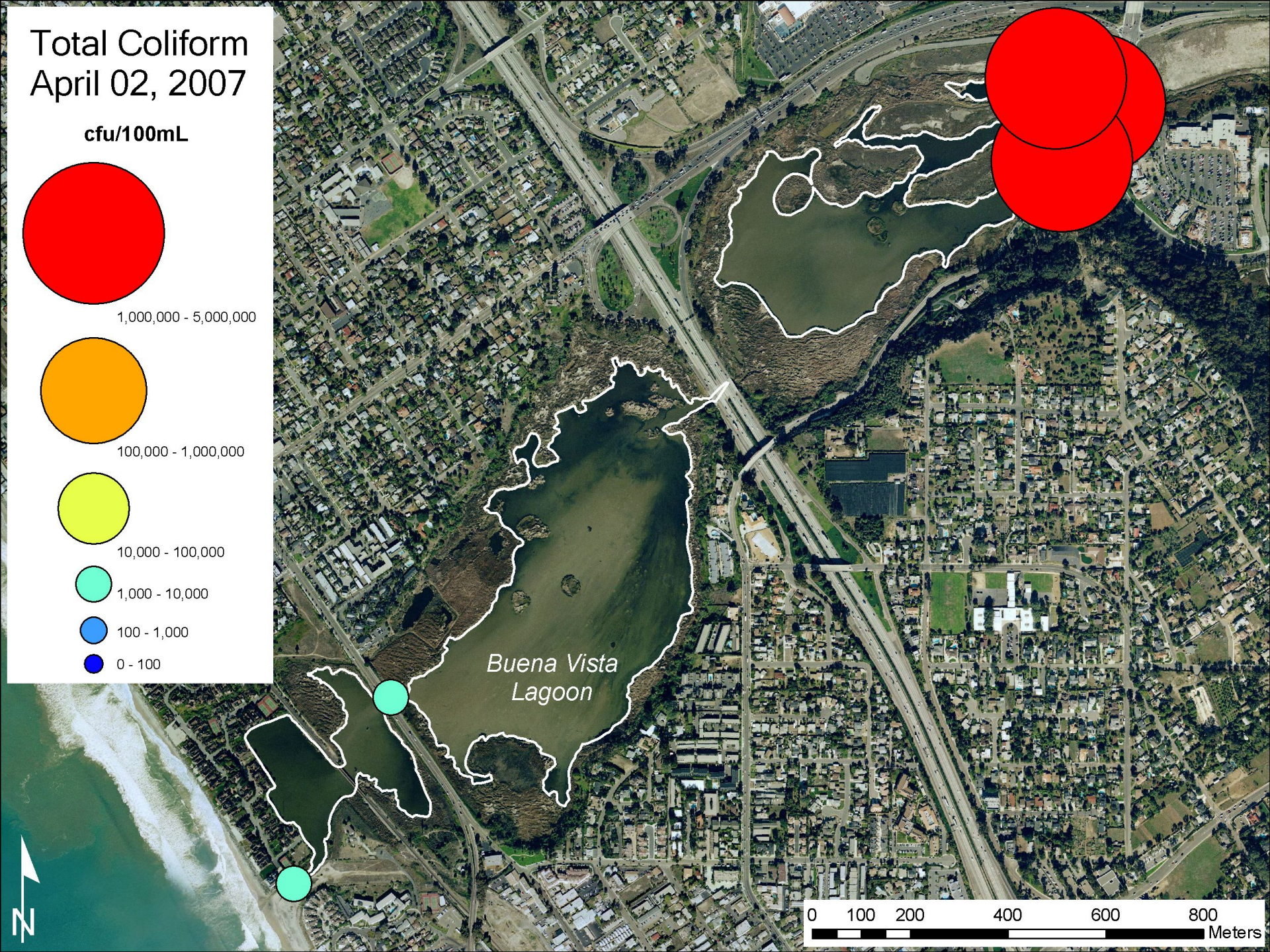
APPENDIX A. DATA MAPS AND FIGURES

A1 – Bacteriological Data

A2 – Water Quality Data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Lagoon
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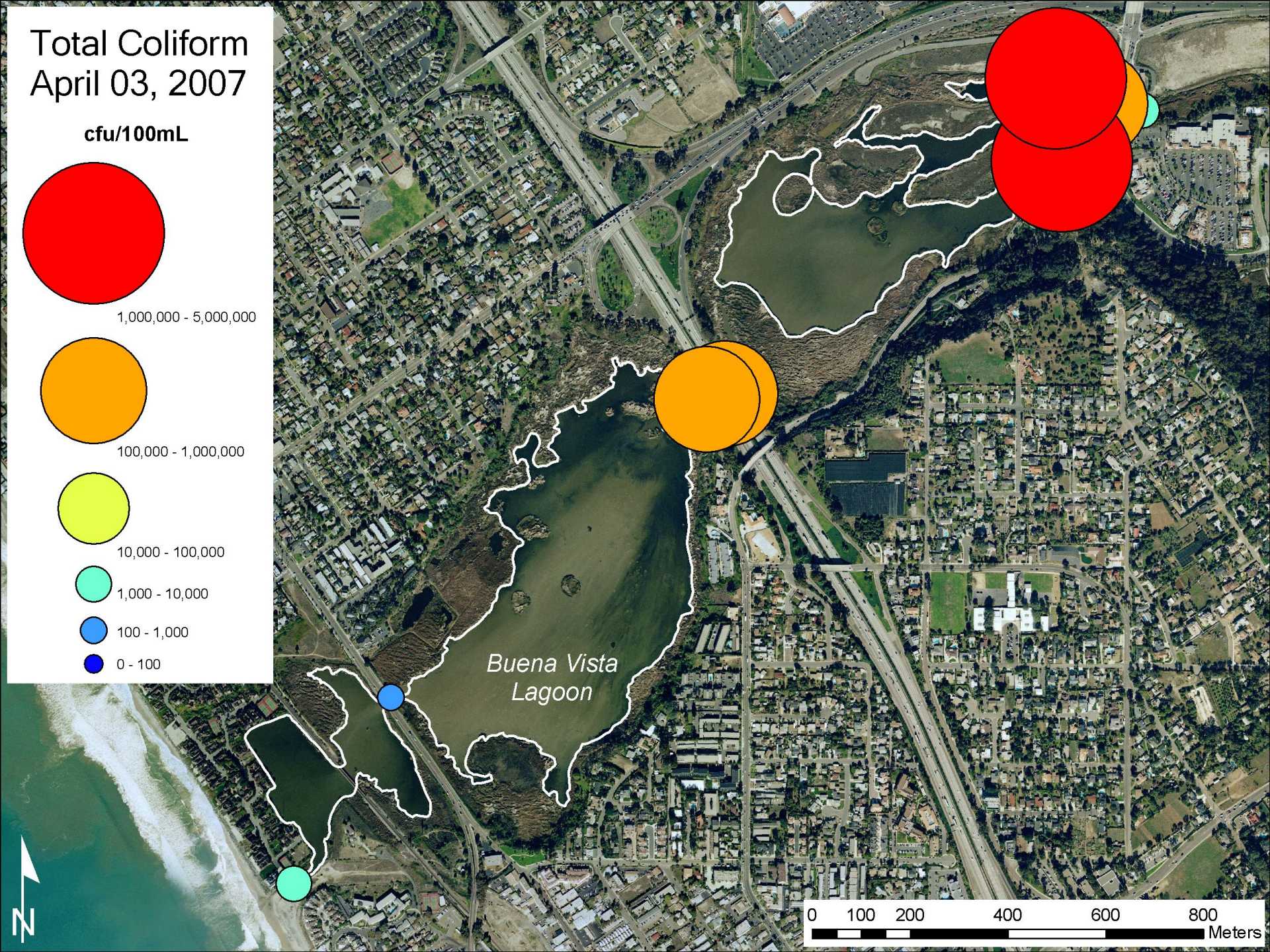
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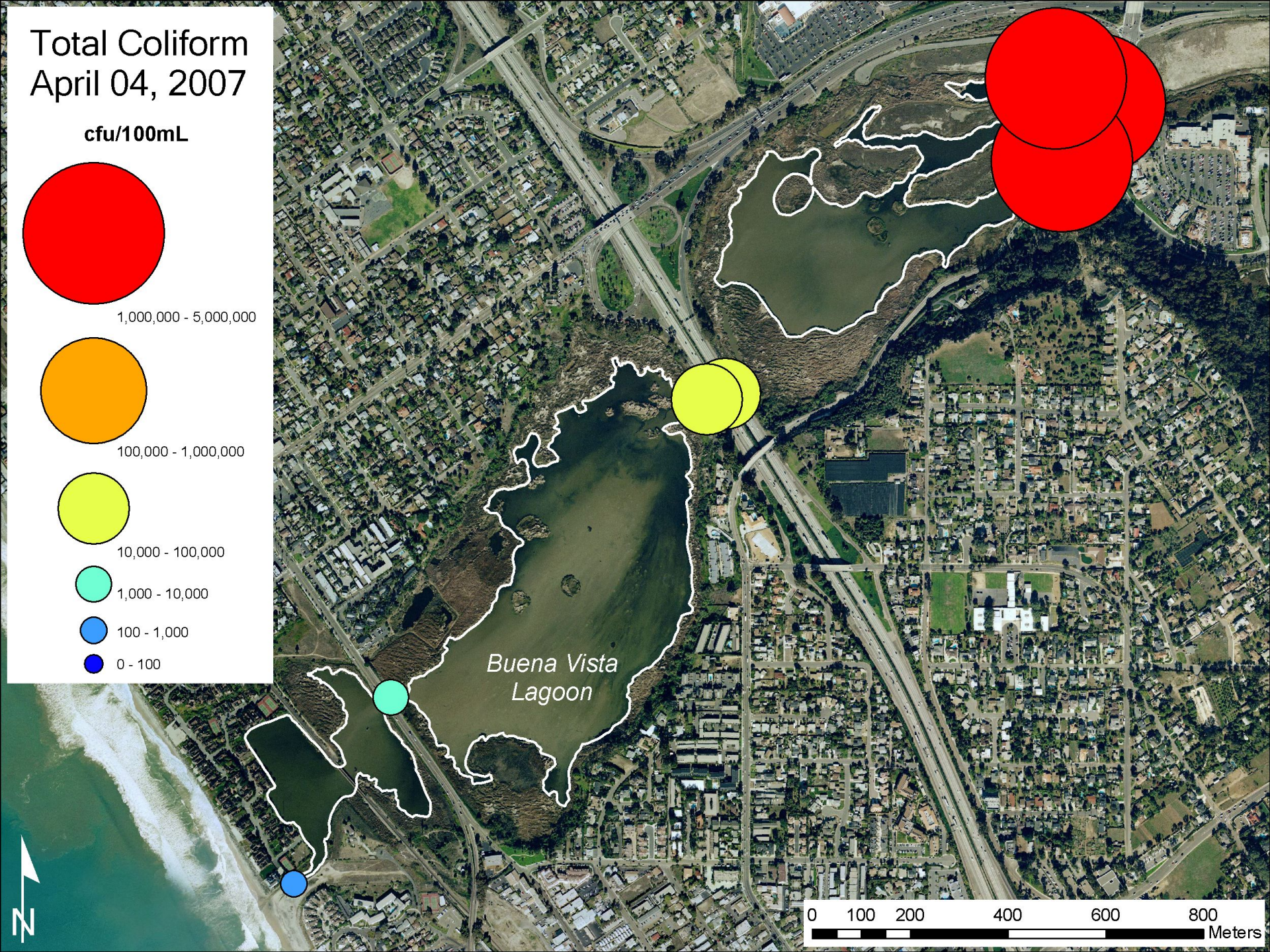
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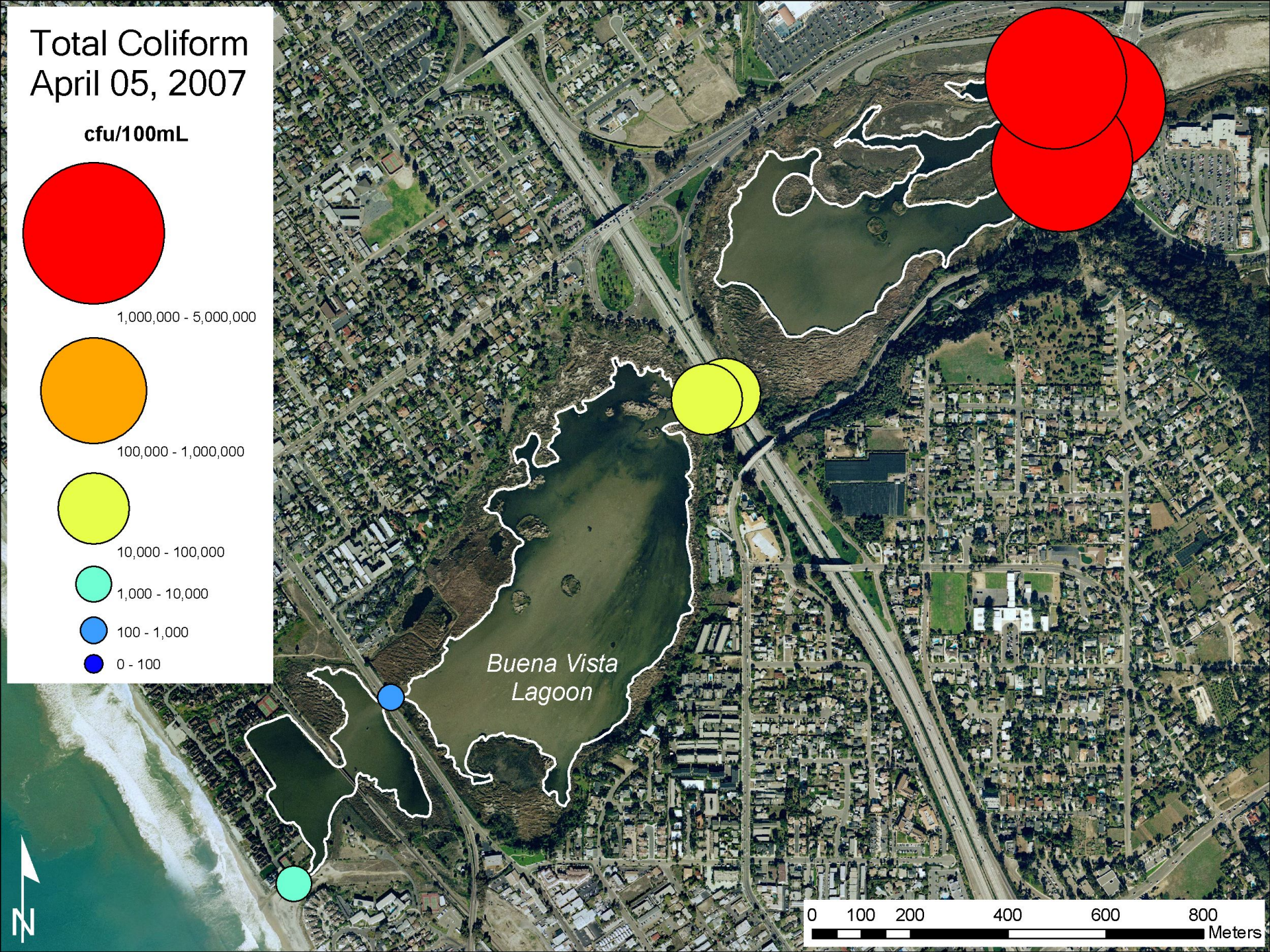
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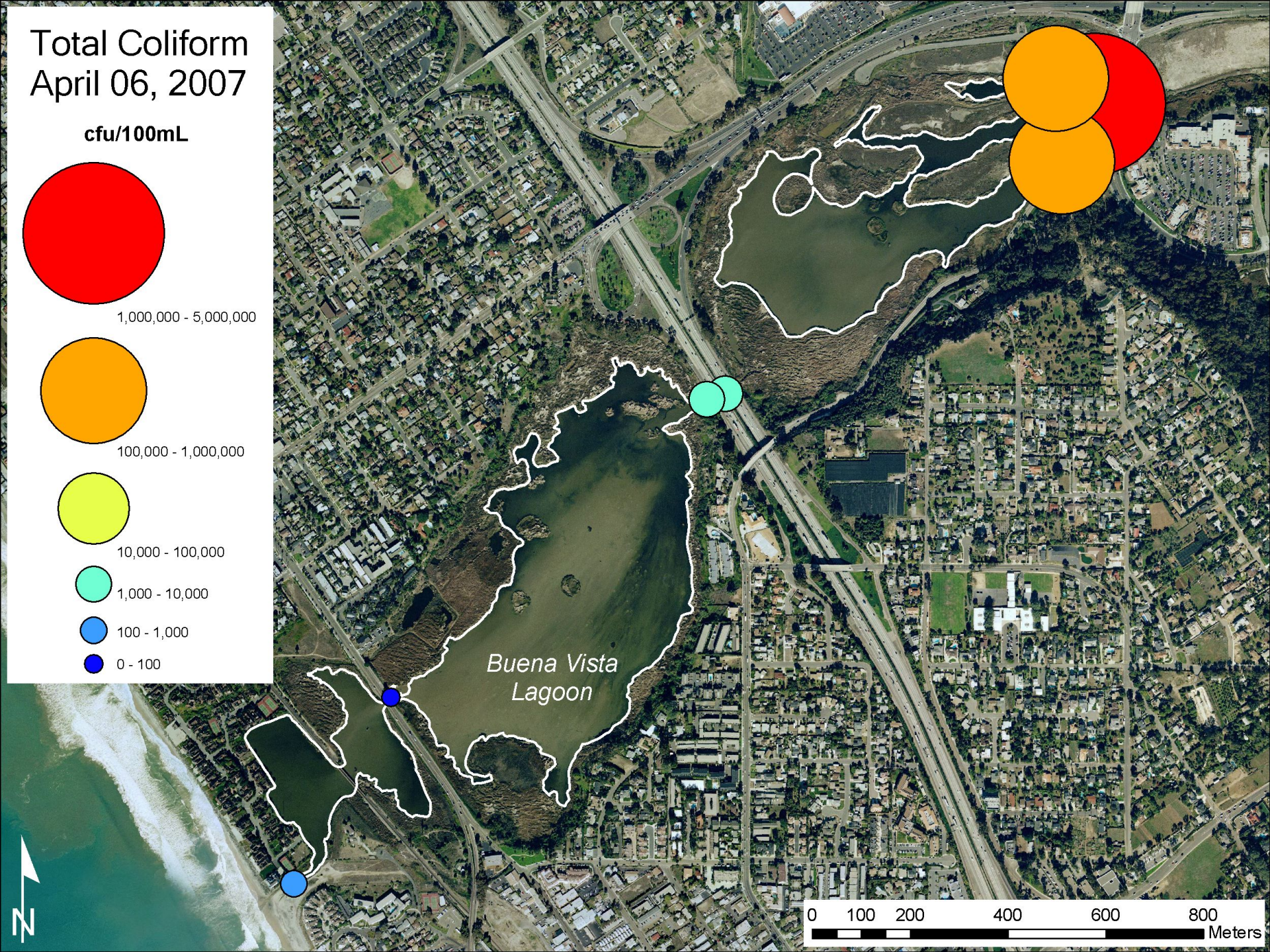
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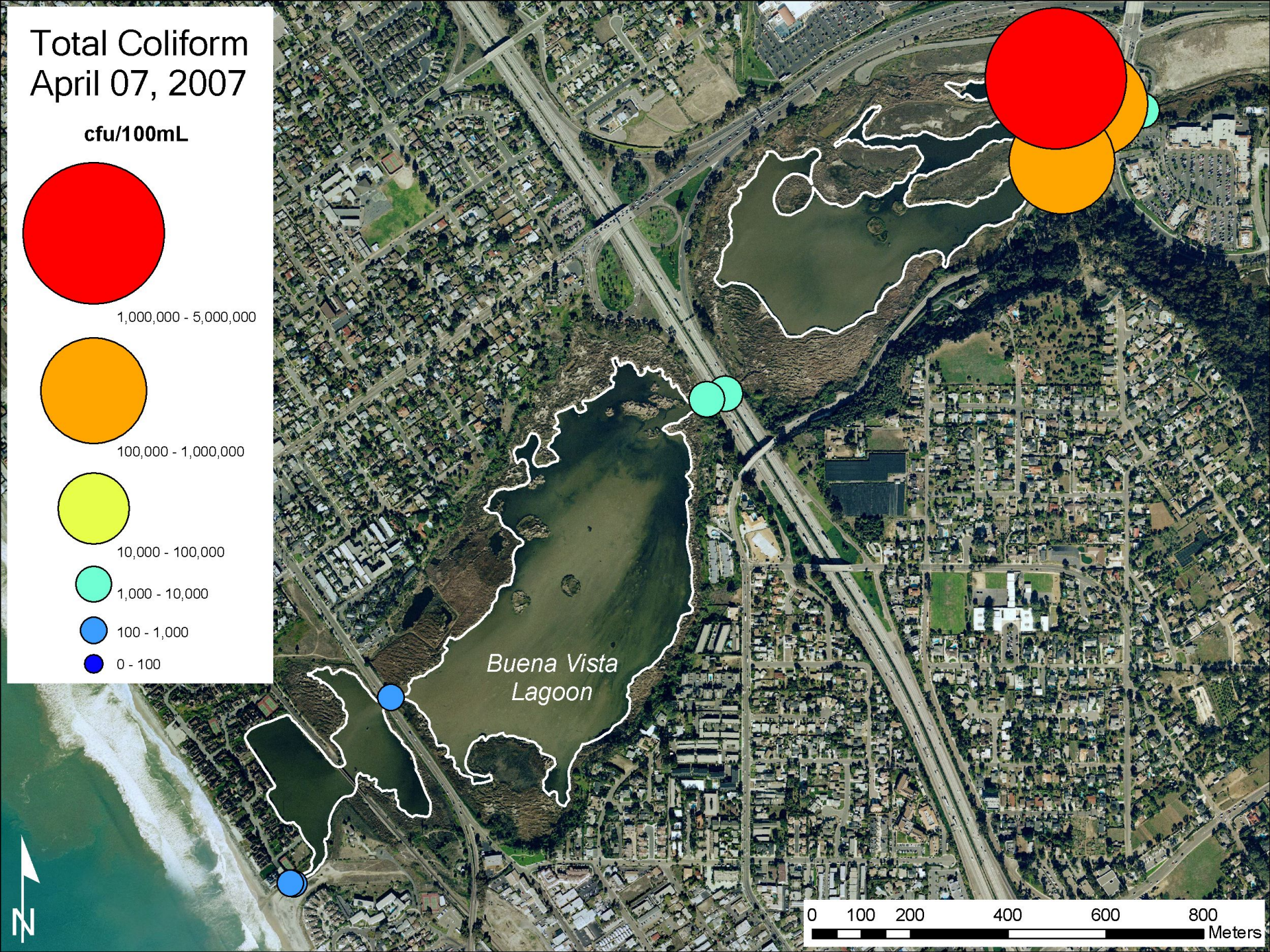
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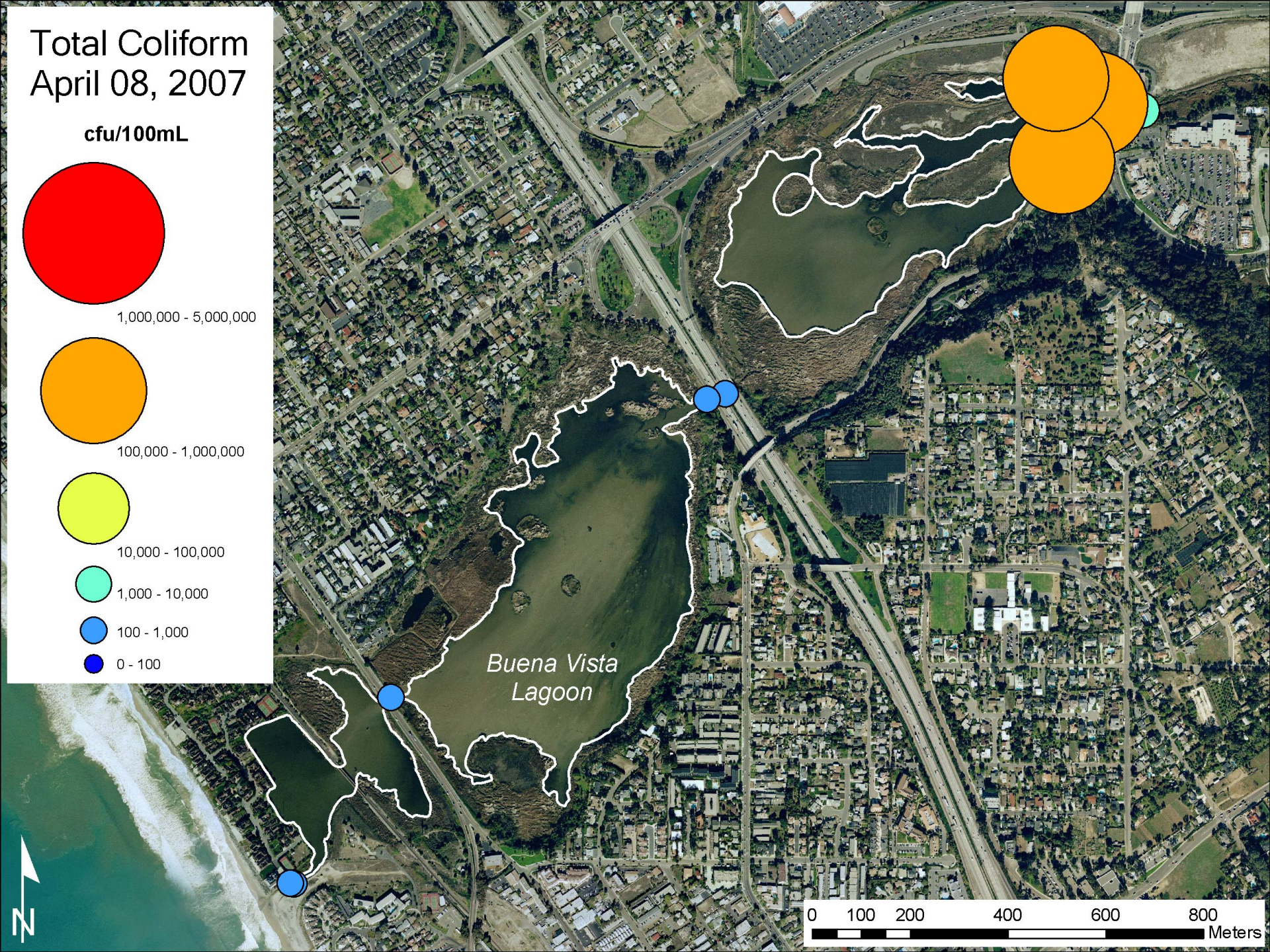
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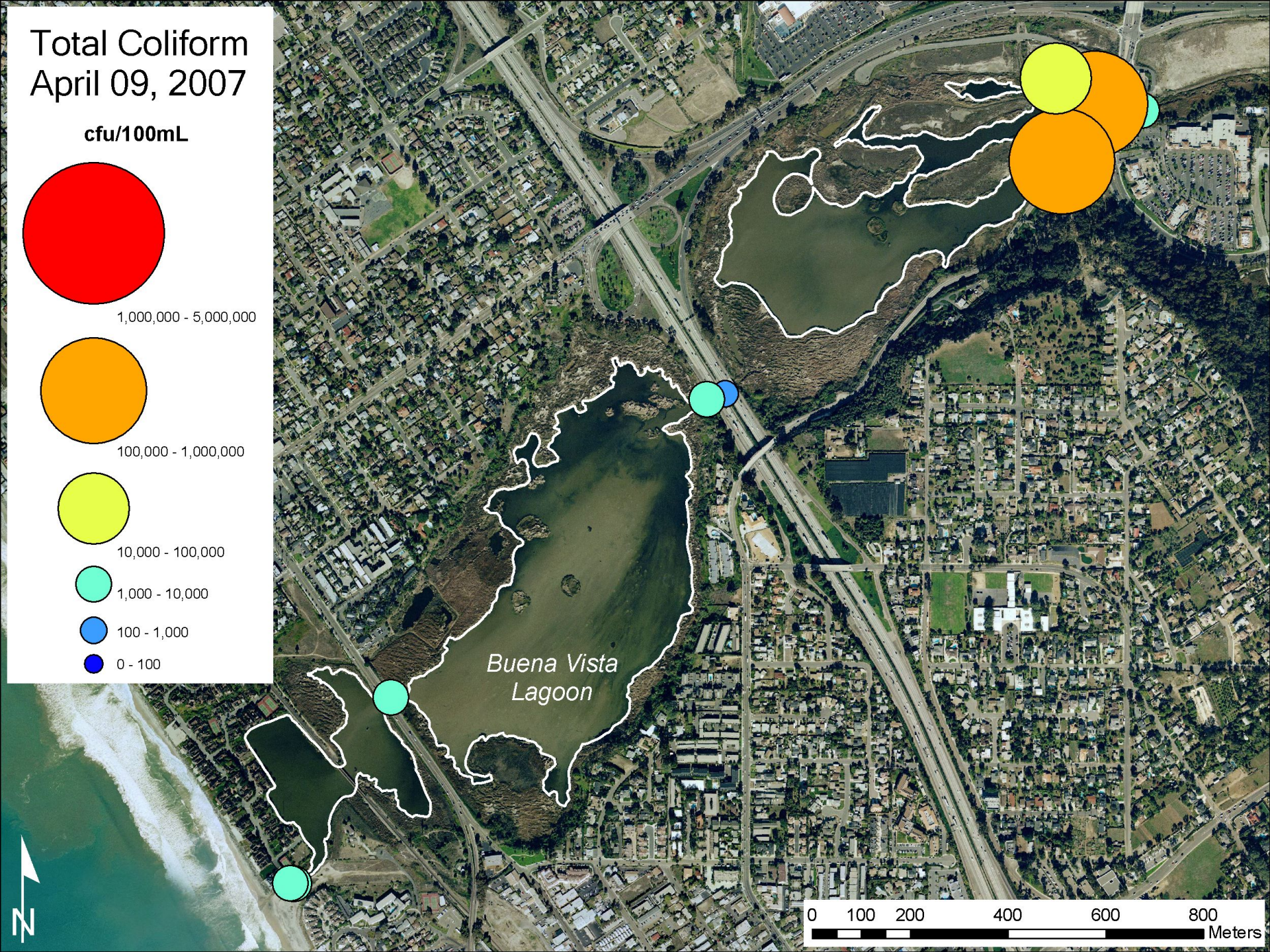
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