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Technical Memorandum

Date:	23 June 2008
To:	Mark Grey, Construction Industry Coalition on Water Quality (CICWQ)
From:	Eric Strecker and Matthew Rea, Geosyntec Consultants Portland
Subject:	Comparison of Crystal Cove Monitoring Data to Draft Construction General Permit Numeric Action Levels and Numeric Effluent Limits

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EXECUTIVE SUMMARY

Geosyntec Consultants conducted an analysis of water quality monitoring data collected from 2002 to 2006 at the Irvine Company's Crystal Cove Development to compare the reported turbidity results with action levels and effluent limits proposed in the California Draft Construction General Permit (DCGP). The turbidity data are organized in tables presented as follows: (1) reported turbidity results from the individual monitoring locations are summarized over the entire monitoring period, and (2) reported turbidity results from all monitoring locations are pooled and summarized for each sampling year. Results are presented and organized by the major receiving water to which sampled runoff flowed, either Muddy Canyon or Los Trancos.

SAMPLING LOCATIONS USED FOR COMPARISON

Six permanent water quality monitoring stations were initially installed as part of the Crystal Cove Stormwater Monitoring Program. A seventh station, Basin 2, was added during the monitoring period 2004-2005 (construction in this area was completed to the point that monitoring could be conducted in early 2005). These water quality monitoring stations were:

1. Station LTU Upper Los Trancos
2. Station LT Los Trancos
3. Station P3A Planning Area 3A
4. Station B6 Outlet of Basin 6
5. Station MC Muddy Creek
6. Station ECU Upper Emerald Creek (Monitoring was abandoned since 2005 – not used for comparison)

7. Station B2 Basin 2 (limited data – not used for comparison)

The permanent monitoring station locations utilized are shown on Figure 1.

Figure 1: Monitoring Station Locations for Comparison to Effluent Limits

COMPLIANCE STORM EVENT

The DCGP contains a provision that exempts discharges from storms greater than the 5 year 24 hour storm event return period from meeting NALs and NELs. The 5 year 24 hour storm event for this project location was estimated using the tool provided by the DCGP to be approximately 3 inches. Only one sampled rain event (Event #5 from 2002-2003 monitoring year) met this

exemption return period, and the sampling results from this event were not included in the data analysis. Events in Tables 1-4 below are listed with rainfall amounts greater than 3 inches; however, these storms lasted a period of days, and did not exceed 3 inches in any 24 hour period; therefore they would be subject to the permit provisions.

Table 1: November 2002- March 2003 Monitored Events

Event	Start/End Dates		Total Rainfall (in)
	Start	End	
1	11/08/02	11/10/02	1.64
2	12/17/02	12/18/02	1.68
3	02/11/03	02/14/03	1.48
4	02/24/03	02/28/03	2.57
5*	***03/15/03***	***03/16003***	***4.08***

Event 5 is an exempted storm event > 5 year return period

Table 2 December 2003- February 2004 Monitored Events

Event	Start/End Dates		Total Rainfall (in)
	Start	End	
1	12/25/03	12/25/03	0.53
2	02/02/04	02/02/04	0.48
3	02/17/04	02/17/04	0.34
4	02/25/04	02/26/04	2.36

Table 3: October 2004 - March 2005 Monitored Events

Event	Start/End Dates		Total Rainfall (in)
	Start	End	
1	10/17/04	10/22/04	2.71
2	10/26/04	10/29/04	3.25
3	02/11/05	02/14/05	1.73
4	02/17/05	02/24/05	6.19
5	03/19/05	03/24/05	0.83

Table 4: January 2006 - April 2006 Monitored Events

Event	Start/End Dates		Total Rainfall (in)
	Start	End	
1	01/01/06	01/03/06	0.61
2	02/27/06	02/28/06	0.67
3	03/10/06	03/11/06	0.43
4	03/28/06	03/29/06	0.91
5	04/14/06	04/14/06	0.28

RESULTS

Comparison vs. Background Condition

The only background turbidity sampling data available that is upstream of the Crystal Cove development are at the Upper Los Trancos sampling station. Sampling results from both discharge locations from the Crystal Cove development (Basin 6 and P3A) were compared against this "background" condition. Table 5 below lists results for these three locations where samples were taken at all three locations on the same day (not all events were sampled for turbidity at all locations). The table also indicates if the discharge was above or below the background level seen in Los Trancos (Los Trancos is not the receiving water for Basin 6; however, is appropriate to use for comparison to background levels in the general area).

Table 5: Comparison of Discharge Turbidity from Crystal Cove Development to Background

SAMPLING STATION	11/08/02	12/16/02	02/13/03	02/25/03	12/25/03	02/18/04	02/26/04	02/12/05	01/03/06	02/28/06	03/12/06	03/29/06	04/14/06	Median
LTU	193	770	545	656	150	32	336	311	1100	37	92	73	120	193
BASIN 6	104	20	43	941	76	41	11	59	774	58	119	236	254	76
P3A	305	624	546	528	6	47	628	391	178	77	188	341	46	305
BASIN 6	-	-	-	+	-	+	-	-	-	+	+	+	+	
P3A	+	-	+	-	-	+	+	+	-	+	+	+	-	

Yellow shading denotes value above NAL of 250 NTU; red shading indicates value above NEL of 500 NTU
- indicates decrease from background turbidity; + indicates increase from background turbidity

Additional sections below present the data in more detail, sorted by watershed and by year.

Muddy Canyon Watershed

The primary discharge location from the Crystal Cove development is Basin 6, which discharges to Muddy Creek on the east side of the development. In the 4 year monitoring record, there have been 36 turbidity samples taken at the outfall from Basin 6. Of these samples, 7 have been greater than 250 NTU (and subsequently above the NAL) and 4 have been greater than 500 NTU (above the NEL). The NEL exceedences occurred during the initial stages of vegetation establishment within the basin (2 during 2002-2003) and after regular maintenance activities for

vegetation removal and sediment cleanup (2 during early 2005-2006). When fully vegetated, as in 2003-2004 and 2004-2005, Basin 6 showed no exceedences of NAL or NEL values, with an average discharge turbidity of 57 and 39 NTU and a maximum discharge turbidity of 139 and 81 NTU respectively. During this same time period that Basin 6 was fully functional and turbidity values were significantly below compliance levels, the receiving water, Muddy Creek, had significantly higher turbidity values that were above the NAL/NEL thresholds. Muddy Creek was sampled 4 times in 2003-2004 and 5 times in 2004-2005. Of these 9 samples, 4 were above the NAL and 3 were above the NEL value. Muddy Creek averaged 297 and 911 NTU over these sampling periods, with maximum values of 741 and 3910 NTU. It should be noted that a majority of the flow in Muddy Creek during late stages of storm events is comprised of discharge from Basin 6. Tables 6, 7 and 8 below contain summary statistics for the full monitoring record for the Muddy Creek watershed.

Table 6 - Basin 6 Sampling Results

Sample Year	# of Samples	Turbidity Sample Median (NTU)	# of Samples > 250 NTU	# of Samples > 500 NTU	% Exceedence of 250 NTU (NAL)	% Exceedence of 500 NTU (NEL)	Maximum Value (NTU)
2002-2003	7	104	3	2	43	29	986
2003-2004	8	41	0	0	0	0	139
2004-2005	11	34	0	0	0	0	81
2005-2006	10	193	4	2	40	20	774
Summary	36	64	7	4	19	11	986

Table 7 - Muddy Creek Sampling Results

Sample Year	# of Samples	Turbidity Sample Median (NTU)	# of Samples > 250 NTU	# of Samples > 500 NTU	% Exceedence of 250 NTU (NAL)	% Exceedence of 500 NTU (NEL)	Maximum Value (NTU)
2002-2003	5	258	2	0	40	0	382
2003-2004	4	196	2	2	50	50	741
2004-2005	5	226	2	1	40	20	3910
2005-2006	5	155	1	1	20	20	1280
Summary	19	196	7	4	37	21	3910

Table 8 – Muddy Canyon Watershed Sampling Results – Entire Monitoring Period

Sampling Location	# of Samples	Turbidity Sample Median (NTU)	# of Samples > 250 NTU	# of Samples > 500 NTU	% Exceedence of 250 NTU (NAL)	% Exceedence of 500 NTU (NEL)	Maximum Value (NTU)
2002-2003							
Basin 6	7	104	3	2	43	29	986
Muddy Creek	5	258	2	0	40	0	382
2003-2004							
Basin 6	8	41	0	0	0	0	139
Muddy Creek	4	196	2	2	50	50	741
2004-2005							
Basin 6	11	34	0	0	0	0	81
Muddy Creek	5	226	2	1	40	20	3910
2005-2006							
Basin 6	10	193	4	2	40	20	774
Muddy Creek	5	155	1	1	20	20	1280
Summary							
Basin 6	36	64	7	4	19	11	986
Muddy Creek	19	196	7	4	37	21	3910

Los Trancos Watershed

In the Los Trancos Watershed, monitoring data was obtained both upstream and downstream from the development discharge; therefore we have a good indication of background turbidity expected to be found during storm events in this watershed. Upper Los Trancos, above any discharge from the Crystal Cove development, was sampled for turbidity 18 times during the 2002-2006 monitoring period. Of the 18 turbidity samples, 7 were above the NAL value of 250 NTU and 4 exceeded the NEL value of 500 NTU, with a maximum value of 1100 NTU during 2005-2006. P3A, located in the southwest corner of the Crystal Cove development, discharges to Los Trancos Creek. During the first three years of the monitoring study, 37% of the sampled discharges from P3A (7 out of 19) exceeded 500 NTU. A similar pattern was observed downstream of the P3A discharge location in Los Trancos Creek, where 7 out of 18 samples

were above 500 NTU. The averages for year 2004-2005 are extremely high (>1400 for both P3A and Los Trancos); however, during this extremely wet year (double the yearly average rainfall), there was one discharge event of over 10,000 NTU that skewed the overall results. The cause of this high recorded turbidity value was investigated and remedied, and no subsequent exceedences of the NAL value were recorded in 2005-2006 from P3A; however, one exceedence was noted in Los Trancos Creek that corresponded to an exceedance in the upstream monitoring location. Tables 9, 10, 11 and 12 below contain summary statistics for the full monitoring record for the Los Trancos watershed.

Table 9 - Upper Los Trancos Sampling Results

Sample Year	# of Samples	Turbidity Sample Median (NTU)	# of Samples > 250 NTU	# of Samples > 500 NTU	% Exceedence of 250 NTU (NAL)	% Exceedence of 500 NTU (NEL)	Maximum Value (NTU)
2002-2003	4	601	3	3	75	75	770
2003-2004	4	168	1	0	25	0	336
2004-2005	5	239	2	0	40	0	492
2005-2006	5	92	1	1	20	20	1100
Summary	18	190	7	4	39	22	1100

Table 10 - P3A Sampling Results

Sample Year	# of Samples	Turbidity Sample Median (NTU)	# of Samples > 250 NTU	# of Samples > 500 NTU	% Exceedence of 250 NTU (NAL)	% Exceedence of 500 NTU (NEL)	Maximum Value (NTU)
2002-2003	4	537	4	3	100	75	624
2003-2004	4	36	1	1	25	25	628
2004-2005	6	260	4	3	67	50	10660
2005-2006	5	178	1	0	20	0	341
Summary	19	188	10	7	53	37	10660

Table 11 - Los Trancos Sampling Results

Sample Year	# of Samples	Turbidity Sample Median (NTU)	# of Samples > 250 NTU	# of Samples > 500 NTU	% Exceedence of 250 NTU (NAL)	% Exceedence of 500 NTU (NEL)	Maximum Value (NTU)
2002-2003	4	624	3	3	75	75	747
2003-2004	4	191	1	1	25	25	894
2004-2005	5	155	2	2	40	40	6203
2005-2006	5	71	2	1	40	20	553
Summary	18	202	8	7	44	39	6203

Table 12 – Los Trancos Watershed Sampling Results – Entire Monitoring Period

Sampling Location	# of Samples	Turbidity Sample Median (NTU)	# of Samples > 250 NTU	# of Samples > 500 NTU	% Exceedence of 250 NTU (NAL)	% Exceedence of 500 NTU (NEL)	Maximum Value (NTU)
2002-2003							
Upper Los Trancos	4	601	3	3	75	75	770
P3A	4	537	4	3	100	75	624
Los Trancos	4	624	3	3	75	75	747
2003-2004							
Upper Los Trancos	4	168	1	0	25	0	336
P3A	4	36	1	1	25	25	628
Los Trancos	4	191	1	1	25	25	894
2004-2005							
Upper Los Trancos	5	239	2	0	40	0	492
P3A	6	260	4	3	67	50	10660
Los Trancos	5	155	2	2	40	40	6203
2005-2006							
Upper Los Trancos	5	92	1	1	20	20	1100
P3A	5	178	1	0	20	0	341
Los Trancos	5	71	2	1	40	20	553
Summary							
Upper Los Trancos	18	190	7	4	39	22	1100
P3A	19	188	10	7	53	37	10660
Los Trancos	18	202	8	7	44	39	6203

CONCLUSIONS

- Turbidity values of samples taken as “background” condition from Los Trancos Creek upstream of the Crystal Cove development often exceeded the proposed turbidity NEL of 500 NTU for storm events less than the 5 year 24 hour return period identified as a “compliance storm event” in the DCGP. During four out of the six exceedences of the

proposed Numeric Effluent Limit from the Crystal Cove development, the background condition (LTU) was equal to or higher in turbidity than the discharge

- Basin 6 had two proposed NEL exceedences in each of the 2002-2003 and 2005-2006 monitoring periods, which corresponded to initial vegetation establishment (2002-2003) and to regular maintenance activities and vegetation removal within the basin (2005-2006). These conditions are typical of a construction-phase sediment basin.

- The 5 year 24 hour compliance event may not adequately capture large storm events that frequently occur in portions of California, due to the temporal component of the standard. For example, nearly eight inches of rainfall fell over twelve days (and six inches within a week) in February 2005; however, no portion of the storm exceeded three inches in a twenty-four hour period to trigger the exemption. It is important to consider long-term precipitation records and basin hydraulics when developing compliance events.