NORTON CORROSION LIMITED

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April 16, 2012

Port of Olympia
Attn: Don Bache
915 Washington Street NE
Olympia, WA 98501

Subject: **DEPOLARIZED CATHODIC PROTECTION INSPECTION**
SHORELINE CONTAINMENT WALL
CASCADE POLE SITE

Mr. Bache:

On March 23, 2012, Norton Corrosion Limited (NCL) completed an inspection of the impressed current cathodic protection (CP) system that protects the buried environmental containment wall from corrosion. Written authorization to perform this work was issued on March 13, 2012.

Work Performed

NCL performed a depolarized survey at each test location and a continuity test to verify effective bonding of the wall. In addition, a site plan was developed to show the location of each test point.

Criteria

NACE International has established criteria that indicate, when used separately or in combination, that adequate CP is being provided. NCL has evaluated your CP system based on the following criteria:

1. Adequate CP is indicated by a potential difference of -0.850 volts or more negative between a steel structure and a saturated copper/copper sulfate (CSE) half-cell. This criterion requires all voltage drops, other than those across the structure-to-electrolyte boundary, to be considered for a valid interpretation of the potential data. Instantaneous-off potential measurements recorded to account for the voltage drops (IR drop) have been used to evaluate the level of protection achieved. The equivalent criterion applicable to a saturated silver/silver chloride (Ag/AgCl) half-cell is -0.750 volts.

2. Adequate protection is also indicated by a cathodic polarization shift of not less than 100-millivolts. This is equivalent to the difference between the instant-off (polarized) and native (depolarized) potential measurements.

Results and Conclusions

The CP system has been off since the first week of January 2012. NCL utilized a high input impedance multi-meter in conjunction with a portable CSE reference cell to measure structure to soil potentials along the wall. The potentials measured indicate that the wall has not fully

depolarized. Native potentials are typically closer to -500 to -600 mV and the offshore side of the wall is more electronegative than the onshore side. Full depolarization of the wall would indicate similar potential levels on each side of the wall. However, comparing the potentials to the 2011 survey indicates that the containment wall is being adequately protected via the 100 mV criterion. Results of the survey are detailed on the attached data sheets.

Two continuity tests were conducted along the wall. One test was performed from each end of the wall and the second from the rectifier negative lead to the end of the wall. NCL utilized a Nilsson model 400 soil resistivity meter and a wire wheel to conduct the continuity test. The resistance of the wire wheel was measured and recorded. The rectifier negative lead was disconnected prior to measuring the resistance along the wall. Results of the tests conclude electrical continuity is present and the results are detailed on the attached data sheets.

The rectifier negative lead was reconnected at the end of the survey and the system left off. NCL will adjust the panel meters accordingly during the next inspection.

Recommendations

Since the potentials along the wall have not fully depolarized, NCL recommends leaving the CP system off for an additional month. At this time, NCL will revisit the site, collect potentials and re-energize the CP system. At this time, the panel meters will be adjusted accordingly.

In addition, NCL recommends continuing to monitor the rectifier voltage and current output every 60 days. The system should operate near 6 volts and a minimum current output of 12 amps. The current may be higher when the offshore anodes are underwater. The higher the tide, the higher the output may be.

This system should be inspected on an annual basis, so your next inspection should be scheduled for April 2013.

NCL appreciates this opportunity to serve the Port of Olympia. If you have any questions or additional concerns, please contact this office.

Sincerely,

Helen Duffy

for Tye Ritz
Corrosion Engineer

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Enclosures (1)

NORTON CORROSION LIMITED

PORT OF OLYMPIA
SHORELINE CONTAINMENT WALL
CASCADE POLE SITE

DATA SHEET: 1 OF 3
NCL JOB: E-20596-M
DATE: 3/23/2012
BY: T. RITZ

SHORELINE CONTAINMENT WALL

Rectifier

Manufacturer:	Universal Rectifiers
Model No:	CSA-ASAI 20-40
Serial No:	011757
AC Input Rating	115/230 volts, 9.9/4.9 amps, 1 ø, set to high primary
DC Output Rating:	20 volts, 40 amps
Anode Bed:	24 – 1 ½ "ø x 60" cast iron canister anodes

Field Measurements	Reading
Panel Meters:	5.75 volts
	15.0 amps
Transformer (4/5 max.):	1/4
Portable Meter:	120.65 volts AC Input
	6.240 volts AC on taps
	4.506 volts
	15.5 amps
Shunt (50A/50 mV)	15.5 mV

Note: Rectifier readings were previously recorded on 9/9/2011.

Weather: sunny & dry, 50° F, 10:00 a.m., low tide.

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PORT OF OLYMPIA
SHORELINE CONTAINMENT WALL
CASCADE POLE SITE

DATA SHEET: 2 OF 3
NCL JOB: E-20596-M
DATE: 3/23/2012
BY: T. RITZ

Anode Output Measurements

Anode Location	Reading	Current (amps DC)
1 - West	5.2 mV	0.52 amps
2	0.0	0.00
3	3.5	0.35
4	4.3	0.43
5	8.0	0.80
6	9.4	0.94
7	8.1	0.81
8	8.2	0.82
9	8.1	0.81
10	7.8	0.78
11	8.1	0.81
12	8.2	0.82
13	8.3	0.83
14	8.2	0.82
15	8.4	0.84
16	7.8	0.78
17	8.0	0.80
18	8.6	0.86
19	8.1	0.81
20	8.3	0.83
21	0.0	0.00
22	2.8	0.28
23	3.3	0.33
24 – East	2.6	0.26

Shunts are 0.01 ohm.

Note: Individual anode outputs were previously recorded on 9/9/2011.

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PORT OF OLYMPIA
SHORELINE CONTAINMENT WALL
CASCADE POLE SITE

DATA SHEET: 3 OF 3
NCL JOB: E-20596-M
DATE: 3/23/2012
BY: T. RITZ

Potential Survey

	Potential (volts DC ref. CSE)					
	Onshore of Wall			Offshore of Wall		
Location	Native (3/2012)	On	Instant Off	Native (3/2012)	On	Instant Off
Portable Cell:						
Fence post 1				-0.750	-1.218	-1.080
Post 5, adj. East TS	-0.622	-0.927	-0.871	-0.696	-1.213	-1.069
Post 10	-0.665	-0.870	-0.845	-0.806	-1.208	-1.064
Post 15	-0.696	-0.820	-0.804	-0.814	-1.333	-1.083
Post 20	-0.692	-0.860	-0.840	-0.820	-1.406	-1.107
Post 25	-0.644	-0.885	-0.864	-0.833	-1.420	-1.123
Post 27, adj. rectifier	-0.661	-0.846	-0.824	-0.832	-1.417	-1.129
Post 30	-0.670	-0.851	-0.835	-0.840	-1.424	-1.135
Post 35	-0.699	-0.840	-0.824	-0.843	-1.494	-1.153
Post 40	-0.710	-0.894	-0.878	-0.844	-1.316	-1.138
Post 45	-0.691	-0.994	-0.910	-0.810	-1.283	-1.121
Post 50				-0.756	-1.218	-1.094
East T.S.: (Post 5)						
Perm. Sat Ag/AgCl Cell	-0.640	-0.606	-0.585			
Port. Cell	-0.616	-0.782	-0.752			
Perm. Ag/Port. CSE		-0.174				
West T.S.: (Post 48)						
Perm. Sat Ag/AgCl Cell	-0.220	-0.588	-0.571 (bad cell)			
Port. Cell	-0.750	-0.989	-0.947			
Perm. Ag/Port. CSE		-0.400				

Continuity Test:
- Wire Wheel: 16 ohms
- East TS to West TS: 18 ohms
- East TS to Rectifier negative: 18 ohms

Note: On and Instant off potentials were previously recorded on 9/9/2011.

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RECTIFIER LOG

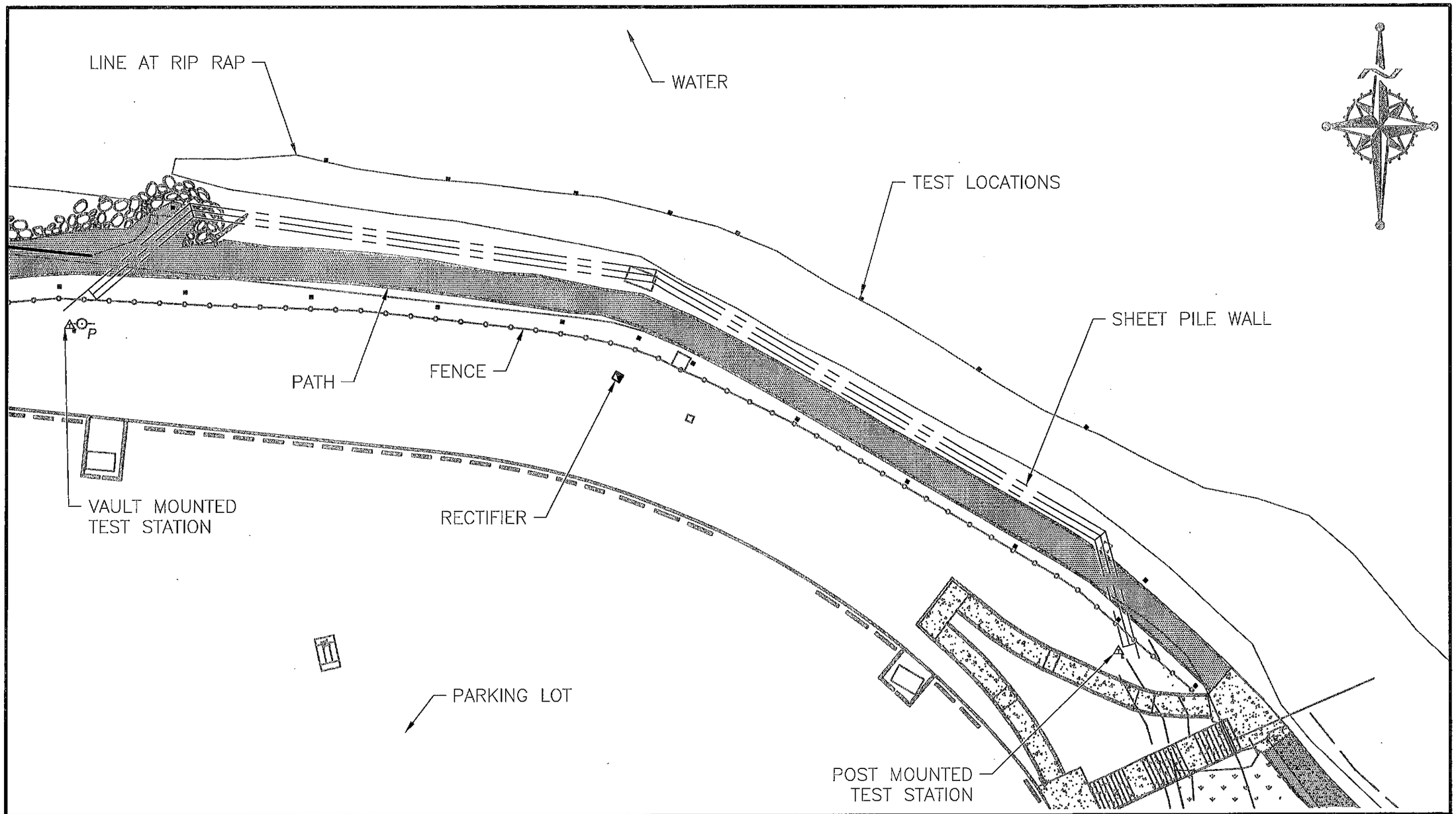
OWNER: PORT OF OLYMPIA

STRUCTURE: Shoreline Containment Wall

RECOMMENDED CURRENT OUTPUT: 15 amps (may vary with tide)

DATE	VOLTS	AMPS	TAPS	INITIAL	COMMENTS
9-9-2011	5.75	15.0	1/4	TR	NCL annual inspection. Low tide.

For assistance, contact NCL at 425-483-1616.



Norton Corrosion Limited
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PORT OF OLYMPIA
CASCADE POLE SITE
CATHODIC PROTECTION TESTING

REF. N.C.L. JOB#: E-20596

Drawing #:	B-20596-01
Designed By:	T.R.
Drawn By:	R. Hunt
Approved By:	T.R.
Date Drawn:	30MAR2012
Revision #:	0
Date Revised:	