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Job #14-358

API 653 INSPECTION

TANK #52

Location: Kerrobert Terminal

Streamline Inspection Ltd.

8/20/2014



This document contains the API 653 inspection information for tank 52, located at the Kerrobert Terminal. Please contact us if there are any questions or comments regarding this report. Thank you for the opportunity to be of service to Enbridge Pipelines Inc.

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1. EXECUTIVE SUMMARY

1.1 Shell to Bottom Weld

An external visual inspection was performed on the shell to bottom weld, soil debris was present on a majority of the BPP, where soil was removed no corrosion was observed.

No indications of corrosion or weld defect were observed as a result.

1.2 Foundation

Tank 52 was situated on an elevated earthen berm area, fill material was a sand/gravel mixture.

A settlement survey was performed; tank 52 did not meet the requirements of API 653. An in depth analysis is in the main body of this report.

1.3 Shell Plates

External visual inspection was performed, no areas of paint failure or corrosion were observed.

Minor deformations of the shell plate were noted.

UT survey was performed on all shell courses around the circumference of the tank, no corrosion was observed as a result of the inspection.

No UT was performed on the 6th shell course due to a 5th course tensioning ring present at the period of inspection.

Internal shell plates were free of product where visible to inspector.

1.4 External Floating Roof

Roof deck plates were visually inspected, no corrosion was observed.

Random UT was performed, no corrosion was observed.

Rolling stair case was in acceptable condition, no damages observed.

Pontoons

A visual inspection was performed on all 24 pontoons. No stains or product were observed within.

Pontoons were observed to be of a vapor tight construction.

Pontoon lids do not have lock down bars or goose neck nozzles.

Random UT was performed on the outer pontoon side wall, nominal thickness of 0.212" recorded, several pontoons showed minor corrosion on the upper portions of the sidewall.

Seal

Secondary wiper installed, no gaps observed.

Wiper tip is in excellent condition, no damages were observed.

Minor product build up was present on shell plates.

Attachments

Vacuums breakers are free of corrosion, sitting level and are pinned into position.

Rood legs are free of corrosion and are pinned so roof is in low position.

Due to vacuum breaker legs being pinned operating the tank below, landing level of the legs is not recommended.

Thief hatches are in good condition.

ARP shows zero corrosion, seal assembly is in good condition.

Gauge pole is socked, seal assembly is in good condition.

1.5 Nozzles, Piping and Appurtenances

AN external visual was performed on the nozzle necks during this outage, no weld defect or corrosion was observed.

UT was performed on external nozzle necks, no corrosion was identified as a result.

1.6 API Standard 653 Compliance

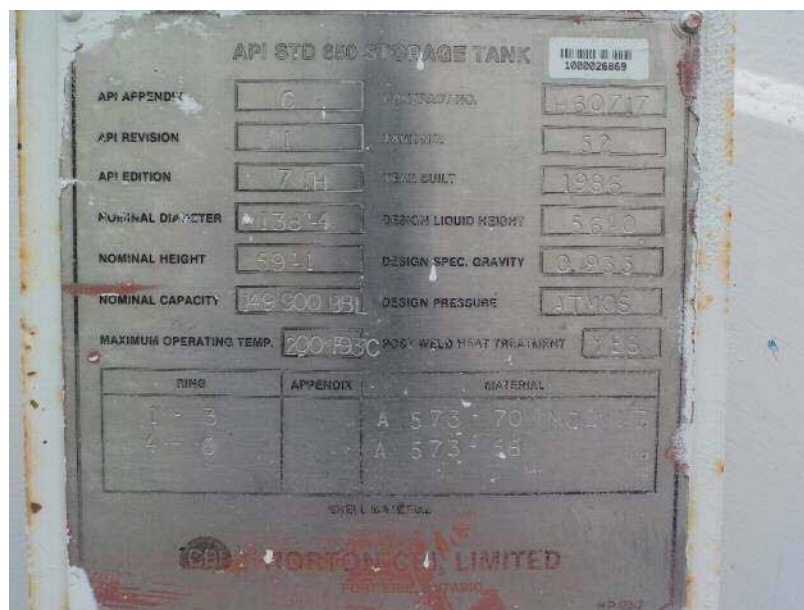
Tank 52 does not meet the settlement requirements of API 653.

1.7 Repair Recommendation Summary

Debris on the BPP should be removed to prevent corrosion as a result of moisture being held against the tank.

Considerations for repair can be made based upon the settlement failure.

2. INTRODUCTION



PHOTOGRAPH 1 NAMEPLATE

TABLE 1 NAME PLATE DATA

| | | | |
|-------------------------|---------------------|---------------------------|----------|
| API Edition: | 7th | Tank No. | 52 |
| API Appendix: | C | Contract No. | H60717 |
| API Revision: | 1 | Year Built: | 1986 |
| Nominal Diameter: | 138' – 0" | Design Liquid Height:: | 56' – 0" |
| Nominal Height: | 59' – 1" | Design Specific Gravity: | 0.933 |
| Nominal Capacity: | 149 900 BBL | Design Pressure: | Atmos. |
| Maximum Operating Temp. | 200°F 93°C | Post Weld Heat Treatment: | Yes |
| Ring 1-3 Material: | A 573-70 | Ring 4-6 Material: | A 573-58 |
| Manufactured By: | Horton CBI, Limited | | |

TABLE 2 FLOATING ROOF NAME PLATE DATA

| | | | |
|------------------|-----------------------|-------------|-------------|
| Contract No. | H60717 | Tank No. | 52 |
| Type: | Horton Type 5 Pontoon | Year Built: | 1986 |
| Manufactured By: | Horton CBI, Limited | Weight: | 191 683 LBS |

TABLE 3 TANK DATA

| | | | |
|-------------------|--------------|--------------------------|-------------|
| Contents: | Storage Tank | Shell Plate Weld Detail: | Butt Weld |
| External Coating: | Paint | Foundation Detail: | Sand/Gravel |
| Roof Type: | Floating | | |

3. INSPECTION SCOPE

Scope of work is to be performed as described in the Enbridge Pipelines Inc. description of work. For areas of work not covered in the above specified document, the Streamline Inspection Ltd scope of work shall be followed. (Note: In areas of overlap between the Streamline scope of work and the Enbridge Pipelines Inc. scope of work, the Enbridge Pipelines Inc. scope of work shall be followed.)

3.1 Shell to Bottom Weld

Complete visual inspection on external shell to bottom weld. (Note: the presence of protective coatings or scale and debris will limit this examination)

Perform magnetic particle examination on the shell to bottom weld. Black on White technique is to be used on the external shell to bottom weld.

3.2 Shell Plates

Random ultrasonic thickness readings will be taken on the first course shell plates with a minimum of eight readings recorded per plate.

Perform thickness measurements in areas of corrosion on the first course shell plates using UT and/or taking pit measurement (Mechanical Gauge).

Perform vertical thickness scans (minimum of 8) up the shell plates, with a minimum of five readings recorded on each shell course. Using API 653 standards, the minimum allowable shell thickness is to be calculated for each course. Accessible shell welds are to be visually inspected for corrosion and weld quality.

Perform a shell plate deflection and roundness survey (minimum of 8 stations). Measurements are taken at a minimum of 80% and 20% of the respective shell courses.

Complete shell plate roll out drawing.

3.3 Nozzles, Piping and Appurtenances

Perform ultrasonic inspection on all accessible internal and external nozzles and man ways on four quadrants (0[A], 90 [B], 180 [C] & 270 [D]).

Perform visual examinations on stairs, ladders, platforms and railings.

Perform magnetic particle examination on all accessible nozzle welds. (When specified by customer)

3.4 Containment and Foundation

Tank bottom and edge settlement evaluation will be conducted as per API 653 Appendix B. External settlement surveys where applicable

Perform visual inspection on tank berm area and foundation.

3.5 Floating Roof

Perform visual and ultrasonic examinations on floating roof deck plates, pontoons and pontoon sidewall.

Complete floating roof drawings.

Perform visual examination of floating roof seal (where applicable).

3.6 Miscellaneous

Complete API internal and external inspection checklist.

Perform volumetric strapping measurement as per Manual of Petroleum Management Standard Chapter 2- Tank calibration.

Preliminary field report and final report

Repair recommendations, settlement cosine graph and inspection interval.

4. INSPECTION RESULTS

4.1 Shell to Bottom Weld

An external visual inspection was performed on the shell to bottom weld, soil debris was present on a majority of the BPP, where soil was removed no corrosion was observed.

No indications of corrosion or weld defect were observed as a result.



PHOTOGRAPH 2 SHELL TO BOTTOM WELD

4.2 Containment and Tank Foundation

Tank 52 was situated on an elevated earthen berm area, fill material was a sand/gravel mixture.

A settlement survey was performed; tank 52 did not meet the requirements of API 653.



PHOTOGRAPH 4 TANK FOUNDATION

4.3 Tank Bottom Settlement Evaluation

An external settlement survey was performed to examine for out of plane or tilt settlement. The settlement was found to be not within compliance of API Standard 653, Annex B.

TABLE 4 EXTERNAL SETTLEMENT SURVEY

| Station Number | Shell Edge |
|--------------------------|------------|
| Rod Readings (in meters) | |
| 1 | 4.350 |
| 2 | 4.370 |
| 3 | 4.360 |
| 4 | 4.420 |
| 5 | 4.460 |
| 6 | 4.460 |
| 7 | 4.420 |
| 8 | 4.360 |
| 9 | 4.340 |
| 10 | 4.335 |
| 11 | 4.310 |
| 12 | 4.280 |
| 13 | 4.310 |
| 14 | 4.340 |

Benchmark = 5.400

Settlement Analysis

Shell Settlement Plot - Tank 52

Streamline Project: Revision 2.0

Client: Enbridge Pipelines Inc.

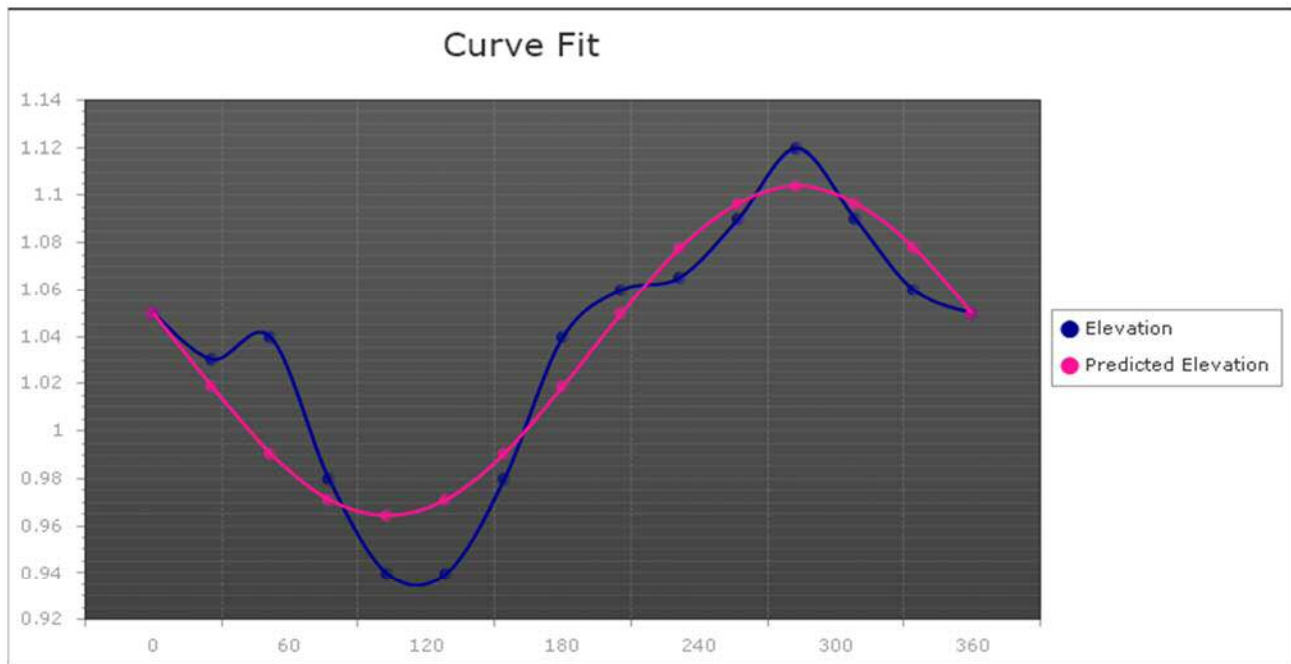
Tank Location: Kerrobert Terminal

Date of Survey: Aug 20, 2014

Date of Analysis: Aug 20, 2014

Tank Description: N/A

Test Description: N/A



Tank Diameter (Meters) = 42.073171
Tank height (Meters) = 17.987805
Max. Out-of-Plane Permitted (inches) = 0.0272545
Max. Observed Out-of-Plane (inches) = 0.0393005
Percent of Permitted = 144.20% **API UNACCEPTABLE**
R-Squared Value of Cosine Curve Fit = 0.857425 **CURVE FIT UNACCEPTABLE**

Station Spacing = 9.4412
Rigid Body Tilt (inches) = 0.0697
Tilt Plane (Degrees) = 192.9036
Mean Elevation = 1.0344
Benchmark Height = 5.4000

Shell Settlement Data - Tank 52

Streamline Project: Revision 2.0

Client: Enbridge Pipelines Inc.

Date of Survey: Aug 20, 2014

Tank Location: Kerrobert Terminal

Date of Analysis: Aug 20, 2014

| <i>Angular Location</i> | <i>Elevation</i> | <i>Predicted Elevation</i> | <i>Out-of-Plane Settlement, U_i</i> | <i>Out-of-Plane Settlement², U_i^2</i> | <i>Out-of-Plane Deflection, S_i</i> | <i>Out-of-Plane Deflection², S_i^2</i> | <i>Differences From the Mean²</i> |
|-------------------------|------------------|----------------------------|--|--|--|--|--|
| 0.0000 | 1.0500 | 1.0499 | 0.0001 | 0.0000 | 0.0001 | 0.0000 | 0.0002 |
| 25.7143 | 1.0300 | 1.0189 | 0.0111 | 0.0001 | -0.0135 | 0.0002 | 0.0000 |
| 51.4286 | 1.0400 | 0.9909 | 0.0491 | 0.0024 | 0.0393 | 0.0015 | 0.0000 |
| 77.1429 | 0.9800 | 0.9716 | 0.0084 | 0.0001 | -0.0038 | 0.0000 | 0.0030 |
| 102.8571 | 0.9400 | 0.9646 | -0.0246 | 0.0006 | -0.0131 | 0.0002 | 0.0089 |
| 128.5714 | 0.9400 | 0.9715 | -0.0315 | 0.0010 | -0.0138 | 0.0002 | 0.0089 |
| 154.2857 | 0.9800 | 0.9908 | -0.0108 | 0.0001 | -0.0057 | 0.0000 | 0.0030 |
| 180.0000 | 1.0400 | 1.0188 | 0.0212 | 0.0004 | 0.0215 | 0.0005 | 0.0000 |
| 205.7143 | 1.0600 | 1.0498 | 0.0102 | 0.0001 | 0.0060 | 0.0000 | 0.0007 |
| 231.4286 | 1.0650 | 1.0778 | -0.0128 | 0.0002 | -0.0143 | 0.0002 | 0.0009 |
| 257.1429 | 1.0900 | 1.0972 | -0.0072 | 0.0001 | -0.0087 | 0.0001 | 0.0031 |
| 282.8571 | 1.1200 | 1.1041 | 0.0159 | 0.0003 | 0.0231 | 0.0005 | 0.0073 |
| 308.5714 | 1.0900 | 1.0972 | -0.0072 | 0.0001 | -0.0062 | 0.0000 | 0.0031 |
| 334.2857 | 1.0600 | 1.0779 | -0.0179 | 0.0003 | -0.0143 | 0.0002 | 0.0007 |
| 360.0000 | 1.0500 | 1.0499 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

4.4 Tank Shell Evaluation

External visual inspection was performed, no areas of paint failure or corrosion were observed.

Minor deformations of the shell plate were noted.

UT survey was performed on all shell courses around the circumference of the tank, no corrosion was observed as a result of the inspection.

No UT was performed on the 6th shell course due to a 5th course tensioning ring present at the period of inspection.

Internal shell plates were free of product where visible to inspector.

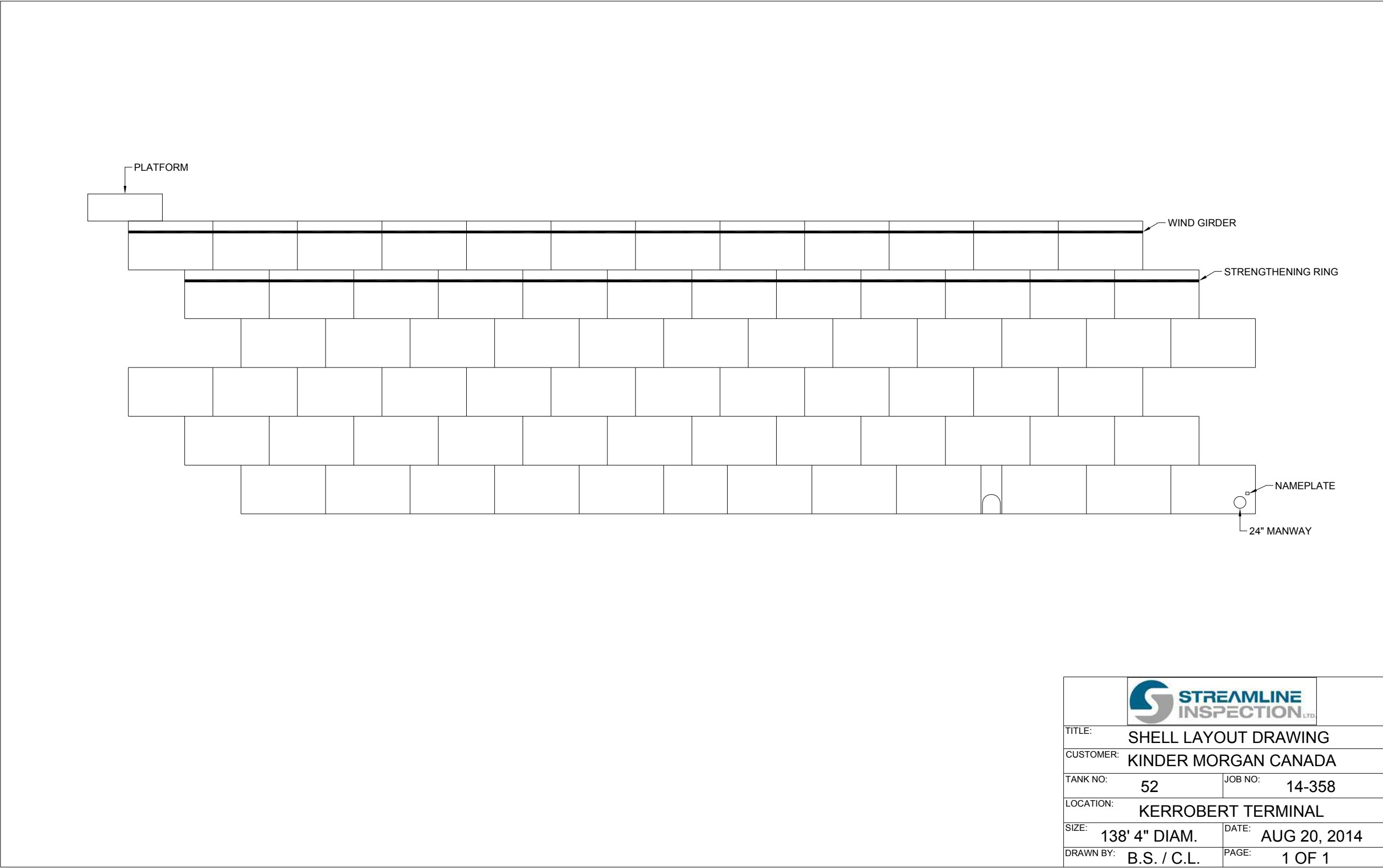


FIGURE 1 SHELL PLATE ROLLOUT

4.6 Shell Ultrasonic Thickness Readings

TABLE 5 SHELL PLATE ULTRASONIC READINGS

(ALL MEASURES IN INCHES)

| Plate Number/ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Course 5 | 0.365 | 0.365 | 0.325 | 0.317 | 0.351 | 0.350 | 0.368 | 0.349 |
| Course 5 | 0.364 | 0.375 | 0.325 | 0.314 | 0.353 | 0.348 | 0.373 | 0.348 |
| Course 5 | 0.364 | 0.373 | 0.323 | 0.315 | 0.353 | 0.351 | 0.370 | 0.350 |
| Course 5 | 0.364 | 0.372 | 0.323 | 0.318 | 0.353 | 0.346 | 0.371 | 0.354 |
| Course 5 | 0.338 | 0.372 | 0.323 | 0.320 | 0.354 | 0.316 | 0.370 | 0.351 |
| Course 5 | 0.325 | 0.372 | 0.322 | 0.316 | 0.353 | 0.315 | 0.369 | 0.337 |
| Course 5 | 0.341 | 0.372 | 0.322 | 0.317 | 0.351 | 0.312 | 0.379 | 0.341 |
| Course 5 | 0.366 | 0.363 | 0.324 | 0.342 | 0.345 | 0.313 | 0.364 | 0.339 |
| Course 5 | 0.366 | 0.362 | 0.326 | 0.345 | 0.337 | 0.341 | 0.374 | 0.337 |
| Course 5 | 0.363 | 0.364 | 0.328 | 0.368 | 0.342 | 0.338 | 0.370 | 0.341 |
| Course 5 | 0.339 | 0.365 | 0.326 | 0.342 | 0.345 | 0.338 | 0.365 | 0.339 |
| Course 5 | 0.341 | 0.366 | 0.327 | 0.337 | 0.341 | 0.341 | 0.368 | 0.340 |
| Course 5 | 0.369 | 0.371 | 0.328 | 0.333 | 0.343 | 0.342 | 0.369 | 0.336 |
| Course 5 | 0.340 | 0.366 | 0.326 | 0.333 | 0.339 | 0.318 | 0.368 | 0.340 |
| Course 5 | 0.346 | 0.370 | 0.320 | 0.333 | 0.340 | 0.339 | 0.364 | 0.340 |
| Course 5 | 0.371 | 0.368 | 0.322 | 0.337 | 0.337 | 0.337 | 0.364 | 0.341 |
| Course 5 | 0.345 | 0.373 | 0.319 | 0.334 | 0.365 | 0.337 | 0.367 | 0.341 |
| Course 5 | 0.369 | 0.369 | 0.319 | 0.330 | 0.360 | 0.337 | 0.370 | 0.342 |
| Course 5 | 0.370 | 0.370 | 0.320 | 0.364 | 0.363 | 0.341 | 0.364 | 0.339 |
| Course 5 | 0.342 | 0.366 | 0.324 | 0.336 | 0.357 | 0.351 | 0.363 | 0.340 |
| Course 4 | 0.469 | 0.469 | 0.425 | 0.425 | 0.417 | 0.451 | 0.439 | 0.436 |
| Course 4 | 0.475 | 0.472 | 0.428 | 0.422 | 0.446 | 0.447 | 0.441 | 0.413 |
| Course 4 | 0.474 | 0.475 | 0.429 | 0.424 | 0.416 | 0.447 | 0.446 | 0.439 |
| Course 4 | 0.482 | 0.476 | 0.427 | 0.423 | 0.444 | 0.453 | 0.444 | 0.440 |
| Course 4 | 0.484 | 0.481 | 0.425 | 0.426 | 0.445 | 0.452 | 0.447 | 0.439 |
| Course 4 | 0.480 | 0.482 | 0.429 | 0.425 | 0.444 | 0.456 | 0.446 | 0.442 |
| Course 4 | 0.481 | 0.482 | 0.429 | 0.451 | 0.444 | 0.457 | 0.450 | 0.440 |
| Course 4 | 0.488 | 0.478 | 0.427 | 0.452 | 0.446 | 0.454 | 0.446 | 0.438 |
| Course 4 | 0.481 | 0.476 | 0.428 | 0.451 | 0.445 | 0.457 | 0.448 | 0.440 |
| Course 4 | 0.474 | 0.475 | 0.429 | 0.451 | 0.447 | 0.457 | 0.447 | 0.441 |
| Course 4 | 0.477 | 0.478 | 0.427 | 0.451 | 0.446 | 0.457 | 0.446 | 0.439 |
| Course 4 | 0.475 | 0.477 | 0.428 | 0.449 | 0.442 | 0.457 | 0.446 | 0.439 |
| Course 4 | 0.446 | 0.474 | 0.428 | 0.451 | 0.461 | 0.477 | 0.468 | 0.440 |
| Course 4 | 0.479 | 0.463 | 0.451 | 0.448 | 0.443 | 0.477 | 0.469 | 0.441 |
| Course 4 | 0.478 | 0.469 | 0.449 | 0.447 | 0.469 | 0.480 | 0.443 | 0.439 |
| Course 4 | 0.478 | 0.473 | 0.451 | 0.449 | 0.444 | 0.478 | 0.469 | 0.441 |
| Course 4 | 0.475 | 0.479 | 0.451 | 0.448 | 0.476 | 0.454 | 0.468 | 0.441 |
| Course 4 | 0.480 | 0.479 | 0.451 | 0.448 | 0.451 | 0.454 | 0.468 | 0.439 |
| Course 4 | 0.449 | 0.475 | 0.455 | 0.448 | 0.452 | 0.477 | 0.470 | 0.440 |
| Course 4 | 0.480 | 0.472 | 0.454 | 0.449 | 0.467 | 0.446 | 0.443 | 0.442 |
| Course 3 | 0.483 | 0.471 | 0.430 | 0.437 | 0.476 | 0.444 | 0.447 | 0.443 |

| Plate Number/ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Course 3 | 0.478 | 0.470 | 0.429 | 0.437 | 0.450 | 0.452 | 0.446 | 0.449 |
| Course 3 | 0.475 | 0.473 | 0.456 | 0.436 | 0.451 | 0.452 | 0.445 | 0.449 |
| Course 3 | 0.477 | 0.473 | 0.456 | 0.439 | 0.449 | 0.454 | 0.468 | 0.444 |
| Course 3 | 0.478 | 0.496 | 0.459 | 0.460 | 0.471 | 0.451 | 0.469 | 0.467 |
| Course 3 | 0.483 | 0.497 | 0.462 | 0.469 | 0.446 | 0.451 | 0.469 | 0.445 |
| Course 3 | 0.481 | 0.477 | 0.461 | 0.462 | 0.453 | 0.455 | 0.470 | 0.444 |
| Course 3 | 0.477 | 0.474 | 0.461 | 0.464 | 0.479 | 0.458 | 0.469 | 0.445 |
| Course 3 | 0.477 | 0.471 | 0.460 | 0.458 | 0.453 | 0.460 | 0.465 | 0.443 |
| Course 3 | 0.483 | 0.470 | 0.457 | 0.458 | 0.451 | 0.460 | 0.466 | 0.469 |
| Course 3 | 0.480 | 0.470 | 0.458 | 0.476 | 0.465 | 0.459 | 0.466 | 0.469 |
| Course 3 | 0.482 | 0.470 | 0.458 | 0.475 | 0.462 | 0.456 | 0.466 | 0.444 |
| Course 3 | 0.486 | 0.471 | 0.434 | 0.471 | 0.460 | 0.455 | 0.465 | 0.469 |
| Course 3 | 0.484 | 0.470 | 0.459 | 0.471 | 0.461 | 0.459 | 0.440 | 0.470 |
| Course 3 | 0.476 | 0.472 | 0.460 | 0.472 | 0.458 | 0.452 | 0.465 | 0.448 |
| Course 3 | 0.475 | 0.474 | 0.456 | 0.472 | 0.464 | 0.453 | 0.466 | 0.444 |
| Course 3 | 0.475 | 0.472 | 0.456 | 0.452 | 0.459 | 0.458 | 0.440 | 0.444 |
| Course 3 | 0.479 | 0.473 | 0.459 | 0.452 | 0.455 | 0.454 | 0.467 | 0.445 |
| Course 3 | 0.492 | 0.505 | 0.486 | 0.453 | 0.453 | 0.453 | 0.467 | 0.444 |
| Course 3 | 0.475 | 0.479 | 0.462 | 0.476 | 0.477 | 0.453 | 0.555 | 0.445 |
| Course 2 | 0.590 | 0.566 | 0.512 | 0.514 | 0.534 | 0.552 | 0.554 | 0.543 |
| Course 2 | 0.588 | 0.565 | 0.529 | 0.513 | 0.533 | 0.548 | 0.554 | 0.541 |
| Course 2 | 0.562 | 0.567 | 0.528 | 0.538 | 0.533 | 0.547 | 0.555 | 0.543 |
| Course 2 | 0.562 | 0.565 | 0.529 | 0.537 | 0.530 | 0.546 | 0.557 | 0.543 |
| Course 2 | 0.587 | 0.589 | 0.556 | 0.540 | 0.533 | 0.551 | 0.555 | 0.543 |
| Course 2 | 0.560 | 0.591 | 0.551 | 0.543 | 0.528 | 0.549 | 0.554 | 0.546 |
| Course 2 | 0.584 | 0.569 | 0.552 | 0.539 | 0.551 | 0.551 | 0.554 | 0.545 |
| Course 2 | 0.587 | 0.565 | 0.553 | 0.562 | 0.552 | 0.553 | 0.553 | 0.546 |
| Course 2 | 0.592 | 0.569 | 0.550 | 0.560 | 0.555 | 0.556 | 0.557 | 0.544 |
| Course 2 | 0.598 | 0.570 | 0.572 | 0.565 | 0.558 | 0.554 | 0.557 | 0.548 |
| Course 2 | 0.598 | 0.565 | 0.550 | 0.540 | 0.555 | 0.563 | 0.556 | 0.543 |
| Course 2 | 0.598 | 0.565 | 0.553 | 0.544 | 0.555 | 0.553 | 0.560 | 0.543 |
| Course 2 | 0.557 | 0.562 | 0.554 | 0.546 | 0.556 | 0.554 | 0.560 | 0.543 |
| Course 2 | 0.600 | 0.564 | 0.553 | 0.575 | 0.556 | 0.559 | 0.559 | 0.542 |
| Course 2 | 0.595 | 0.564 | 0.551 | 0.548 | 0.556 | 0.559 | 0.560 | 0.542 |
| Course 2 | 0.592 | 0.563 | 0.551 | 0.545 | 0.542 | 0.559 | 0.561 | 0.542 |
| Course 2 | 0.595 | 0.585 | 0.577 | 0.569 | 0.562 | 0.559 | 0.558 | 0.544 |
| Course 2 | 0.597 | 0.560 | 0.574 | 0.572 | 0.561 | 0.557 | 0.558 | 0.548 |
| Course 2 | 0.599 | 0.560 | 0.572 | 0.570 | 0.560 | 0.556 | 0.563 | 0.545 |
| Course 2 | 0.598 | 0.558 | 0.552 | 0.549 | 0.560 | 0.556 | 0.674 | 0.679 |
| Course 1 | 0.708 | 0.698 | 0.699 | 0.705 | 0.702 | 0.684 | 0.673 | 0.676 |
| Course 1 | 0.705 | 0.694 | 0.698 | 0.706 | 0.702 | 0.687 | 0.676 | 0.674 |
| Course 1 | 0.706 | 0.699 | 0.698 | 0.711 | 0.706 | 0.686 | 0.673 | 0.676 |
| Course 1 | 0.677 | 0.695 | 0.701 | 0.701 | 0.710 | 0.684 | 0.677 | 0.676 |
| Course 1 | 0.704 | 0.696 | 0.693 | 0.700 | 0.705 | 0.687 | 0.676 | 0.676 |
| Course 1 | 0.702 | 0.694 | 0.715 | 0.697 | 0.702 | 0.684 | 0.671 | 0.674 |
| Course 1 | 0.700 | 0.691 | 0.698 | 0.698 | 0.703 | 0.688 | 0.671 | 0.674 |
| Course 1 | 0.707 | 0.696 | 0.695 | 0.701 | 0.707 | 0.682 | 0.674 | 0.679 |

| Plate Number/ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Course 1 | 0.705 | 0.693 | 0.698 | 0.703 | 0.705 | 0.685 | 0.676 | 0.677 |
| Course 1 | 0.705 | 0.696 | 0.698 | 0.701 | 0.710 | 0.687 | 0.671 | 0.674 |
| Course 1 | 0.704 | 0.690 | 0.697 | 0.702 | 0.704 | 0.684 | 0.675 | 0.677 |
| Course 1 | 0.709 | 0.696 | 0.695 | 0.702 | 0.701 | 0.686 | 0.676 | 0.672 |
| Course 1 | 0.704 | 0.713 | 0.697 | 0.702 | 0.707 | 0.682 | 0.671 | 0.674 |
| Course 1 | 0.705 | 0.693 | 0.700 | 0.702 | 0.709 | 0.705 | 0.690 | 0.675 |
| Course 1 | 0.702 | 0.691 | 0.700 | 0.700 | 0.699 | 0.707 | 0.674 | 0.675 |
| Course 1 | 0.702 | 0.696 | 0.694 | 0.701 | 0.704 | 0.683 | 0.674 | 0.675 |
| Course 1 | 0.709 | 0.695 | 0.699 | 0.719 | 0.703 | 0.684 | 0.672 | 0.680 |
| Course 1 | 0.703 | 0.695 | 0.699 | 0.705 | 0.709 | 0.678 | 0.698 | 0.675 |
| Course 1 | 0.705 | 0.693 | 0.696 | 0.702 | 0.703 | 0.685 | 0.691 | 0.674 |
| Course 1 | 0.707 | 0.692 | 0.685 | 0.703 | 0.704 | 0.679 | 0.673 | 0.676 |
| Course 1 | 0.702 | 0.690 | 0.686 | 0.704 | 0.704 | 0.676 | 0.673 | 0.679 |
| Course 1 | 0.703 | 0.690 | 0.694 | 0.703 | 0.702 | 0.679 | 0.675 | 0.676 |
| Course 1 | 0.703 | 0.695 | 0.690 | 0.700 | 0.698 | 0.681 | 0.672 | 0.671 |
| Course 1 | 0.701 | 0.693 | 0.688 | 0.703 | 0.704 | 0.678 | 0.673 | 0.676 |
| Course 1 | 0.705 | 0.688 | 0.698 | 0.703 | 0.702 | 0.676 | 0.676 | 0.673 |
| Course 1 | 0.702 | 0.689 | 0.692 | 0.708 | 0.703 | 0.676 | 0.667 | 0.676 |
| Course 1 | 0.699 | 0.695 | 0.698 | 0.706 | 0.703 | 0.677 | 0.671 | 0.672 |
| Course 1 | 0.704 | 0.694 | 0.693 | 0.707 | 0.754 | 0.672 | 0.671 | 0.675 |
| Course 1 | 0.702 | 0.694 | 0.694 | 0.731 | 0.700 | 0.677 | 0.672 | 0.674 |
| Course 1 | 0.704 | 0.697 | 0.690 | 0.731 | 0.706 | 0.679 | 0.672 | 0.671 |
| Course 1 | 0.702 | 0.691 | 0.693 | 0.707 | 0.699 | 0.675 | 0.679 | 0.676 |
| Course 1 | 0.705 | 0.692 | 0.697 | 0.704 | 0.699 | 0.679 | 0.672 | 0.674 |
| Course 1 | 0.698 | 0.691 | 0.698 | 0.707 | 0.699 | 0.677 | 0.674 | 0.671 |
| Course 1 | 0.706 | 0.694 | 0.687 | 0.705 | 0.699 | 0.677 | 0.675 | 0.674 |
| Course 1 | 0.702 | 0.694 | 0.698 | 0.705 | 0.700 | 0.681 | 0.672 | 0.674 |
| Course 1 | 0.704 | 0.693 | 0.695 | 0.702 | 0.699 | 0.679 | 0.676 | 0.689 |
| Course 1 | 0.706 | 0.690 | 0.688 | 0.702 | 0.699 | 0.676 | 0.673 | 0.689 |
| Course 1 | 0.702 | 0.696 | 0.695 | 0.707 | 0.711 | 0.680 | 0.676 | 0.671 |
| Course 1 | 0.705 | 0.698 | 0.696 | 0.707 | 0.699 | 0.678 | 0.674 | 0.692 |
| Course 1 | 0.705 | 0.693 | 0.697 | 0.708 | 0.701 | 0.676 | 0.673 | 0.673 |
| Course 1 | 0.702 | 0.694 | 0.710 | 0.707 | 0.694 | 0.680 | 0.679 | 0.672 |
| Course 1 | 0.702 | 0.689 | 0.694 | 0.707 | 0.696 | 0.680 | 0.672 | 0.690 |
| Course 1 | 0.701 | 0.694 | 0.695 | 0.703 | 0.697 | 0.686 | 0.674 | 0.692 |
| Course 1 | 0.701 | 0.692 | 0.693 | 0.703 | 0.701 | 0.687 | 0.671 | 0.674 |
| Course 1 | 0.703 | 0.692 | 0.693 | 0.705 | 0.700 | 0.690 | 0.672 | 0.674 |
| Course 1 | 0.702 | 0.692 | 0.692 | 0.705 | 0.694 | 0.686 | 0.673 | 0.675 |
| Course 1 | 0.701 | 0.696 | 0.694 | 0.707 | 0.697 | 0.686 | 0.673 | 0.675 |
| Course 1 | 0.703 | 0.696 | 0.693 | 0.701 | 0.700 | 0.685 | 0.672 | 0.678 |
| Course 1 | 0.705 | 0.700 | 0.693 | 0.707 | 0.697 | 0.688 | 0.667 | 0.672 |
| Course 1 | 0.700 | 0.700 | 0.691 | 0.704 | 0.698 | 0.689 | 0.673 | 0.677 |
| Course 1 | 0.705 | 0.697 | 0.692 | 0.709 | 0.726 | 0.689 | 0.673 | 0.673 |
| Course 1 | 0.706 | 0.700 | 0.690 | 0.705 | 0.697 | 0.676 | 0.672 | 0.675 |
| Course 1 | 0.703 | 0.717 | 0.694 | 0.706 | 0.727 | 0.672 | 0.672 | 0.678 |
| Course 1 | 0.702 | 0.695 | 0.694 | 0.704 | 0.696 | 0.673 | 0.670 | 0.674 |
| Course 1 | 0.706 | 0.699 | 0.698 | 0.709 | 0.695 | 0.672 | 0.671 | 0.674 |

| Plate Number/ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Course 1 | 0.703 | 0.696 | 0.691 | 0.706 | 0.696 | 0.674 | 0.679 | 0.674 |
| Course 1 | 0.703 | 0.702 | 0.696 | 0.715 | 0.699 | 0.674 | 0.672 | 0.674 |
| Course 1 | 0.697 | 0.696 | 0.720 | 0.708 | 0.699 | 0.676 | 0.673 | 0.672 |
| Course 1 | 0.699 | 0.699 | 0.697 | 0.705 | 0.699 | 0.674 | 0.677 | 0.675 |
| Course 1 | 0.696 | 0.699 | 0.698 | 0.706 | 0.699 | 0.679 | 0.675 | 0.675 |
| Course 1 | 0.700 | 0.693 | 0.698 | 0.702 | 0.687 | 0.676 | 0.676 | 0.675 |
| Course 1 | 0.704 | 0.699 | 0.710 | 0.703 | 0.686 | 0.673 | 0.678 | 0.677 |
| Course 1 | 0.702 | 0.701 | 0.697 | 0.707 | 0.691 | 0.680 | 0.672 | 0.674 |
| Course 1 | 0.705 | 0.697 | 0.705 | 0.704 | 0.689 | 0.677 | 0.675 | 0.674 |
| Course 1 | 0.703 | 0.699 | 0.713 | 0.703 | 0.691 | 0.674 | 0.675 | 0.674 |
| Course 1 | 0.704 | 0.698 | 0.692 | 0.705 | 0.686 | 0.675 | 0.676 | 0.678 |
| Course 1 | 0.704 | 0.700 | 0.694 | 0.709 | 0.685 | 0.676 | 0.675 | 0.673 |
| Course 1 | 0.711 | 0.699 | 0.688 | 0.703 | 0.687 | 0.686 | 0.675 | 0.674 |
| Course 1 | 0.705 | 0.697 | 0.690 | 0.703 | 0.690 | 0.676 | 0.671 | 0.674 |
| Course 1 | 0.704 | 0.702 | 0.705 | 0.707 | 0.688 | 0.675 | 0.674 | 0.678 |
| Course 1 | 0.698 | 0.701 | 0.699 | 0.709 | 0.690 | 0.675 | 0.673 | 0.676 |
| Course 1 | 0.705 | 0.693 | 0.713 | 0.716 | 0.687 | 0.676 | 0.676 | 0.679 |
| Course 1 | 0.701 | 0.693 | 0.693 | 0.710 | 0.690 | 0.670 | 0.670 | 0.675 |
| Course 1 | 0.704 | 0.698 | 0.695 | 0.706 | 0.682 | 0.675 | 0.671 | 0.672 |
| Course 1 | 0.701 | 0.698 | 0.689 | 0.710 | 0.687 | 0.673 | 0.675 | 0.676 |
| Course 1 | 0.701 | 0.700 | 0.691 | 0.701 | 0.690 | 0.671 | 0.671 | 0.669 |
| Course 1 | 0.701 | 0.704 | 0.711 | 0.707 | 0.688 | 0.671 | 0.671 | 0.675 |
| Course 1 | 0.704 | 0.745 | 0.711 | 0.704 | 0.688 | 0.675 | 0.688 | 0.668 |
| Course 1 | 0.676 | 0.704 | 0.697 | 0.703 | 0.683 | 0.673 | 0.670 | 0.672 |
| Course 1 | 0.701 | 0.699 | 0.694 | 0.706 | 0.683 | 0.677 | 0.671 | 0.689 |
| Course 1 | 0.700 | 0.699 | 0.699 | 0.702 | 0.686 | 0.675 | 0.672 | 0.688 |
| Course 1 | 0.706 | 0.698 | 0.696 | 0.702 | 0.684 | 0.676 | 0.691 | 0.688 |
| Course 1 | 0.704 | 0.699 | 0.688 | 0.702 | 0.687 | 0.676 | 0.671 | 0.672 |
| Course 1 | 0.711 | 0.697 | 0.692 | 0.703 | 0.690 | 0.676 | 0.671 | 0.670 |
| Course 1 | 0.708 | 0.699 | 0.698 | 0.703 | 0.690 | 0.671 | 0.672 | 0.675 |
| Course 1 | 0.708 | 0.699 | 0.698 | 0.707 | 0.685 | 0.673 | 0.692 | 0.673 |
| Course 1 | 0.708 | 0.698 | 0.698 | 0.717 | 0.702 | 0.673 | 0.691 | 0.675 |
| Course 1 | 0.699 | 0.700 | 0.697 | 0.712 | 0.682 | 0.671 | 0.691 | 0.673 |
| Course 1 | 0.705 | 0.701 | 0.699 | 0.708 | 0.687 | 0.672 | 0.691 | 0.672 |
| Course 1 | 0.702 | 0.698 | 0.696 | 0.710 | 0.702 | 0.696 | 0.678 | 0.711 |
| Course 1 | 0.714 | 0.696 | 0.694 | 0.703 | 0.702 | 0.674 | 0.684 | 0.674 |
| Course 1 | 0.705 | 0.697 | 0.695 | 0.704 | 0.682 | 0.674 | 0.675 | 0.674 |
| Course 1 | 0.708 | 0.697 | 0.693 | 0.706 | 0.678 | 0.676 | 0.679 | 0.673 |
| Course 1 | 0.704 | 0.691 | 0.689 | 0.706 | 0.681 | 0.674 | 0.676 | 0.674 |
| Course 1 | 0.706 | 0.691 | 0.690 | 0.703 | 0.682 | 0.674 | 0.679 | 0.673 |
| Course 1 | 0.710 | 0.690 | 0.690 | 0.702 | 0.682 | 0.674 | 0.674 | 0.688 |
| Course 1 | 0.710 | 0.689 | 0.696 | 0.705 | 0.682 | 0.673 | 0.675 | 0.671 |
| Course 1 | 0.708 | 0.693 | 0.698 | 0.706 | 0.676 | 0.673 | 0.674 | 0.671 |
| Course 1 | 0.706 | 0.693 | 0.690 | 0.704 | 0.682 | 0.675 | 0.674 | 0.674 |
| Course 1 | 0.707 | 0.698 | 0.689 | 0.702 | 0.681 | 0.676 | 0.676 | 0.673 |

TABLE 6 SHELL PLATE DESIGN THICKNESS USED FOR PRODUCT

| | |
|---------------------|--|
| Allowable Thickness | $T = 2.6(H-1)DG/SE$ |
| Corrosion Rate | Corr. Rate = $T_{\text{nominal}} - T_{\text{min}} / Y$ |
| H | Product Height – Full height to bottom of overflow 56 feet |
| D | Diameter of Tank (138'4") |
| Gw | Specific Gravity of Water (1) |
| Gp | Specific Gravity of Product (0.810) |
| E | Joint Efficiency (API 7 th Edition Butt Weld 1.00) |
| S | A573-70 & A573-58 |
| Tmin | Minimum Shell Plate Thickness (Not including isolated pitting) |
| Tallow | Minimum Allowable Thickness |
| Tnominal | Nominal Thickness of Shell Plate |
| Y | Years in Service (28) |

TABLE 7 SHELL PLATE DESIGN THICKNESS USING GRAVITY OF 1000 (WATER)

| Course | Course Height (ft) | Product Height (ft) | Allowable Stress | Joint Efficiency | Minimum Thickness | Required Thickness | Ruling |
|--------|--------------------|---------------------|------------------|------------------|-------------------|--------------------|--------------|
| 1 | 10 | 56 | 30000 | 1.0 | 0.667 | 0.659 | Acceptable |
| 2 | 10 | 46 | 30000 | 1.0 | 0.512 | 0.539 | Unacceptable |
| 3 | 10 | 36 | 27400 | 1.0 | 0.429 | 0.472 | Unacceptable |
| 4 | 10 | 26 | 27400 | 1.0 | 0.413 | 0.328 | Acceptable |
| 5 | 10 | 16 | 27400 | 1.0 | 0.312 | 0.209 | Acceptable |
| 6 | 9'1 | 6 | 27400 | 1.0 | 0.250 | 0.078(0.100) | Acceptable |

TABLE 8 SHELL PLATE DESIGN THICKNESS USING GRAVITY OF 810 (PRODUCT)

| Course | Course Height (ft) | Product Height (ft) | Allowable Stress | Joint Efficiency | Minimum Thickness | Required Thickness | Ruling |
|--------|--------------------|---------------------|------------------|------------------|-------------------|--------------------|------------|
| 1 | 10 | 56 | 30000 | 1.0 | 0.667 | 0.543 | Acceptable |
| 2 | 10 | 46 | 30000 | 1.0 | 0.512 | 0.446 | Acceptable |
| 3 | 10 | 36 | 27400 | 1.0 | 0.429 | 0.372 | Acceptable |
| 4 | 10 | 26 | 27400 | 1.0 | 0.413 | 0.276 | Acceptable |
| 5 | 10 | 16 | 27400 | 1.0 | 0.312 | 0.170 | Acceptable |
| 6 | 9'1 | 6 | 27400 | 1.0 | 0.250 | 0.100 | Acceptable |

Note:

Corrosion rate is assumed to be linear for this calculation; the possibility exists that protective coatings may have been applied during the life of the tank effectively arresting the product side corrosion or changes in service may accelerate or decelerate the rate of product side corrosion.

The general corrosion rate has been calculated using approximate nominal shell plate thickness.

All measurements in inches

As per API Standard 653 Section 4.3.3.1 - *t_{min}* shall not be less than 0.1 in. for any tank course.



PHOTOGRAPH 3 SHELL PLATES

4.7 Nozzles and Manways

An external visual was performed on the nozzle necks during this outage, no weld defect or corrosion was observed.

UT was performed on external nozzle necks, no corrosion was identified as a result.

TABLE 9 NOZZLE AND MANWAY EXTERNAL UT THICKNESS RESULTS

| Description | Size (inches) | Location | Reinforcing Plate | | | Neck Thickness (inches) | | | | Flange Thick (inches) | Cover Thick (inches) | Tell-tale | Weld Space (inches) | Comments CL=Center Line |
|-------------|---------------|----------|-------------------|-----------------|----------------|-------------------------|-------|-------|-------|-----------------------|----------------------|-----------|---------------------|----------------------------|
| | | | Width (inches) | Height (inches) | Thick (inches) | 0 | 90 | 180 | 270 | | | | | |
| Manway | 24 | 0 | 48 | 48 | 0.696 | 0.549 | 0.551 | 0.534 | 0.552 | 0.750 | 0.750 | Yes | 6 | 32 |
| Nozzle | 4 | 18'-6" | 12 | 12 | 0.746 | 0.362 | 0.354 | 0.334 | 0.360 | 1.00 | - | Yes | 6 | 12 |
| Nozzle | 6 | 37'-6" | 12 | 12 | 0.738 | 0.459 | 0.462 | 0.434 | 0.466 | 1.00 | | Yes | 6 | 14 |
| Nozzle | 1 | 37'-6" | THD | - | - | - | - | - | - | 0.750 | - | - | - | 48 |
| Nozzle | 24 | 55'-8" | 50 | 48 | 0.740 | 0.576 | 0.583 | 0.562 | 0.574 | - | - | - | - | - |
| Nozzle | 1 | 75'-0" | THD | - | - | - | - | - | - | - | - | - | - | - |
| Mixer | 24 | 93'-0" | 62 | 62 | 0.706 | 0.554 | 0.559 | 0.533 | 0.561 | - | - | - | - | - |
| D-Door | 48 x 36 | 110'-11" | 90 | 54 | 0.738 | 0.779 | 0.777 | 0.783 | 0.781 | - | - | - | - | - |
| Nozzle | 4 | 165'-6" | 12 | 12 | 0.733 | 0.374 | 0.384 | 0.357 | 0.382 | 0.750 | - | Yes | 6 | 12 |
| Nozzle | 6 | 184'-0" | 16 | 16 | 0.726 | 0.475 | 0.485 | 0.445 | 0.473 | 1.00 | - | Yes | 6 | 14 |
| Nozzle | 1 | 184'-0" | THD | - | - | - | - | - | - | 0.750 | - | - | - | 48 |
| Manway | 24 | 192'-3" | 48 | 48 | 0.700 | 0.566 | 0.543 | 0.533 | 0.569 | 0.500 | 0.750 | Yes | 6 | 32 |
| Nozzle | 24 | 268'-0" | 48 | 52 | 0.737 | 0.581 | 0.572 | 0.553 | 0.574 | 2.00 | - | Yes | - | 26 |
| Nozzle | 24 | 275'-4" | 48 | 52 | 0.704 | 0.566 | 0.542 | 0.535 | 0.541 | 2.00 | - | Yes | - | 26 |
| Nozzle | 24 | 282'-0" | 48 | 52 | 0.727 | 0.555 | 0.544 | 0.531 | 0.557 | 2.00 | - | Yes | - | 26 |
| Nozzle | 4 | 311'-8" | 12 | 12 | 0.708 | 0.380 | 0.371 | 0.342 | 0.381 | 1.00 | - | Yes | 6 | 12 |
| Nozzle | 6 | 321'-0" | 12 | 12 | 0.722 | 0.460 | 0.464 | 0.450 | 0.448 | 1.00 | - | Yes | 6 | 14 |
| Nozzle | 1 | 321'-0" | THD | - | - | - | - | - | - | 0.750 | - | - | - | 48 |
| Nozzle | 4 | 330'-5" | 12 | 12 | 0.724 | 0.368 | 0.371 | 0.353 | 0.371 | 1.00 | - | Yes | - | 6 |
| Manway | 30 | 334'-8" | 106 | 63 | 0.697 | 0.557 | 0.557 | 0.560 | 0.570 | 2.00 | 0.300 | Yes | - | 36 |
| Manway | 24 | 339'-10" | 106 | 63 | 0.706 | 0.540 | 0.570 | 0.551 | 0.567 | 0.500 | 0.750 | Yes | - | 32 |



PHOTOGRAPH 4 EXTERNAL NOZZLES AND PIPING



PHOTOGRAPH 5 MANWAYS



PHOTOGRAPH 6 EXTERNAL NOZZLES AND PIPING



PHOTOGRAPH 7 EXTERNAL NOZZLES AND PIPING

4.8 Floating Roof Evaluation

Roof deck plates were visually inspected, no corrosion was observed.

Random UT was performed, no corrosion was observed.

Rolling stair case was in acceptable condition, no damages observed.

Pontoons

A visual inspection was performed on all 24 pontoons. No stains or product were observed within.

Pontoons were observed to be of a vapor tight construction.

Pontoon lids do not have lock down bars or goose neck nozzles.

Random UT was performed on the outer pontoon side wall, nominal thickness of 0.212" recorded, several pontoons showed minor corrosion on the upper portions of the sidewall.

Seal

Secondary wiper installed, no gaps observed.

Wiper tip is in excellent condition, no damages were observed.

Minor product build up was present on shell plates.

Attachments

Vacuums breakers are free of corrosion, sitting level and are pinned into position.

Rood legs are free of corrosion and are pinned so roof is in low position.

Due to vacuum breaker legs being pinned operating the tank below, landing level of the legs is not recommended.

Thief hatches are in good condition.

ARP shows zero corrosion, seal assembly is in good condition.

Gauge pole is soaked, seal assembly is in good condition.

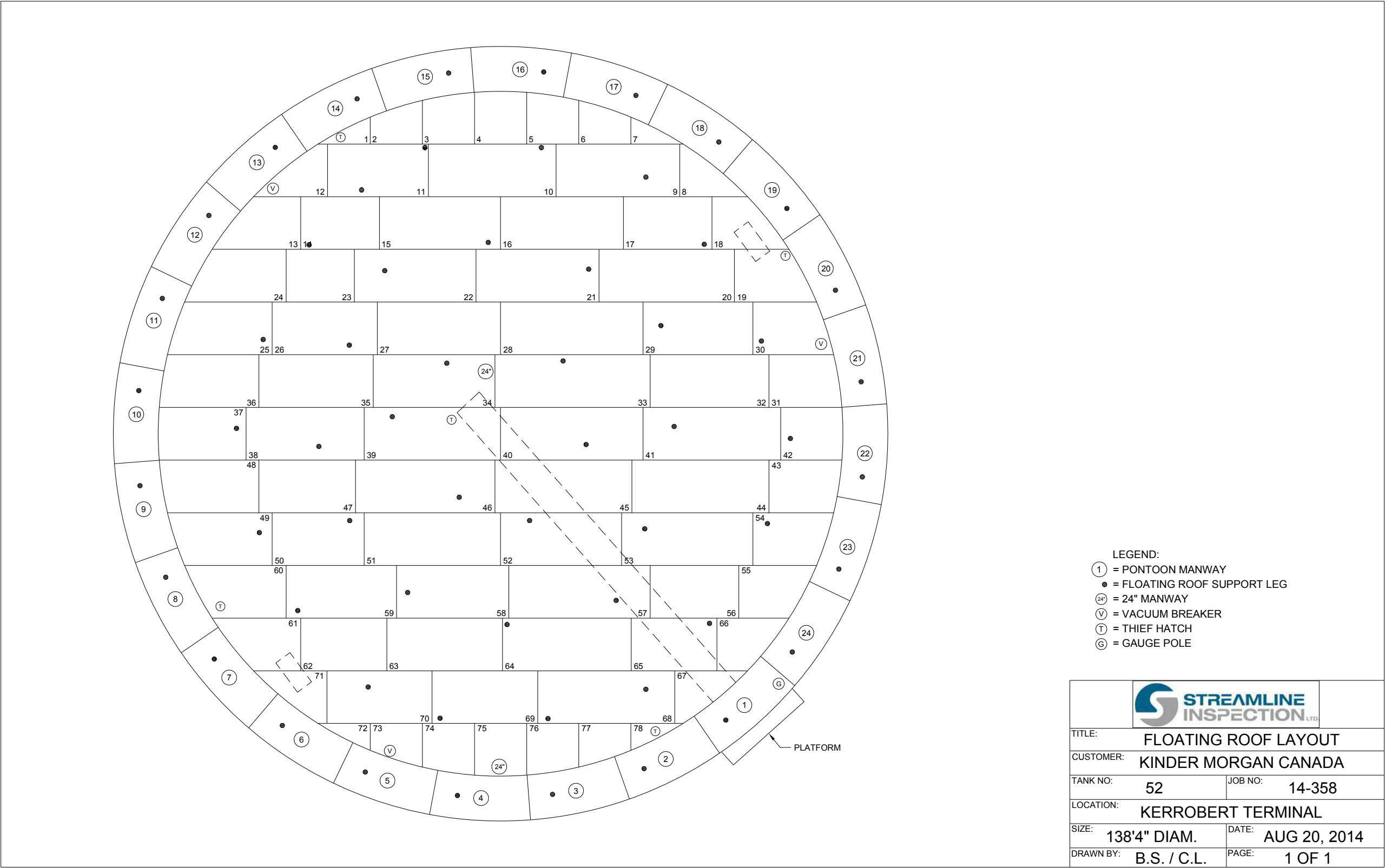


FIGURE 2 EXTERNAL FLOATING ROOF DRAWING

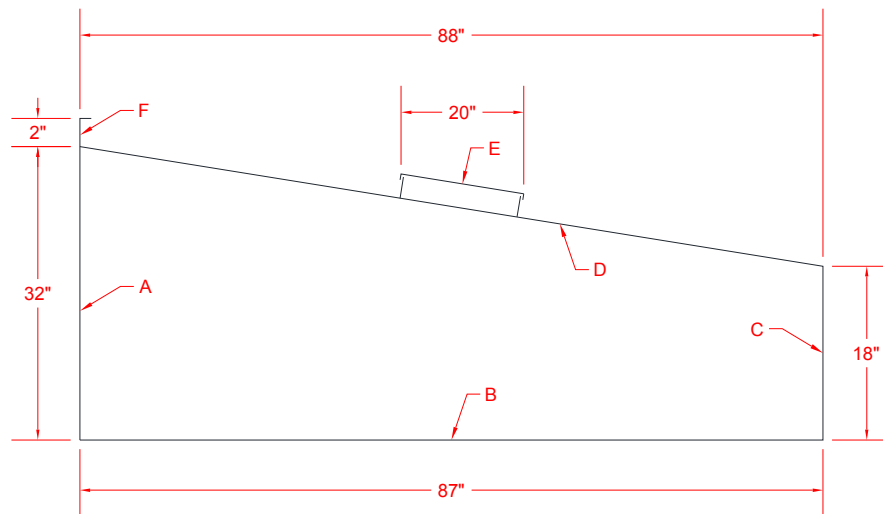
TABLE 10 FLOATING ROOF DECK PLATE THICKNESS READINGS

| Plate Number/ID | 1 | 2 | 3 | 4 |
|-----------------|-------|-------|-------|-------|
| 1 | 0.242 | 0.238 | 0.225 | 0.235 |
| 2 | 0.227 | 0.230 | 0.230 | 0.237 |
| 3 | 0.236 | 0.239 | 0.238 | 0.239 |
| 4 | 0.236 | 0.230 | 0.229 | 0.228 |
| 5 | 0.228 | 0.233 | 0.236 | 0.242 |
| 6 | 0.238 | 0.240 | 0.239 | 0.233 |
| 7 | 0.237 | 0.235 | 0.233 | 0.232 |
| 8 | 0.234 | 0.233 | 0.230 | 0.231 |
| 9 | 0.233 | 0.231 | 0.226 | 0.230 |
| 10 | 0.230 | 0.235 | 0.236 | 0.233 |
| 11 | 0.229 | 0.231 | 0.228 | 0.233 |
| 12 | 0.228 | 0.230 | 0.233 | 0.240 |
| 13 | 0.243 | 0.232 | 0.228 | 0.230 |
| 14 | 0.229 | 0.231 | 0.231 | 0.230 |
| 15 | 0.237 | 0.230 | 0.233 | 0.230 |
| 16 | 0.230 | 0.226 | 0.229 | 0.229 |
| 17 | 0.227 | 0.229 | 0.231 | 0.233 |
| 18 | 0.235 | 0.235 | 0.226 | 0.235 |
| 19 | 0.228 | 0.233 | 0.232 | 0.238 |
| 20 | 0.241 | 0.236 | 0.236 | 0.236 |
| 21 | 0.234 | 0.232 | 0.235 | 0.238 |
| 22 | 0.251 | 0.240 | 0.240 | 0.240 |
| 23 | 0.235 | 0.237 | 0.231 | 0.239 |
| 24 | 0.230 | 0.240 | 0.240 | 0.235 |
| 25 | 0.235 | 0.232 | 0.232 | 0.231 |
| 26 | 0.231 | 0.230 | 0.226 | 0.231 |
| 27 | 0.240 | 0.240 | 0.234 | 0.233 |
| 28 | 0.229 | 0.232 | 0.236 | 0.235 |
| 29 | 0.233 | 0.240 | 0.235 | 0.228 |
| 30 | 0.230 | 0.236 | 0.238 | 0.242 |
| 31 | 0.233 | 0.235 | 0.234 | 0.239 |
| 32 | 0.229 | 0.232 | 0.229 | 0.233 |
| 33 | 0.231 | 0.232 | 0.235 | 0.236 |
| 34 | 0.230 | 0.233 | 0.233 | 0.235 |
| 35 | 0.237 | 0.233 | 0.239 | 0.228 |
| 36 | 0.235 | 0.234 | 0.239 | 0.233 |
| 37 | 0.234 | 0.231 | 0.232 | 0.230 |

| Plate Number/ID | 1 | 2 | 3 | 4 |
|-----------------|-------|-------|-------|-------|
| 38 | 0.240 | 0.239 | 0.236 | 0.232 |
| 39 | 0.235 | 0.235 | 0.235 | 0.237 |
| 40 | 0.239 | 0.237 | 0.241 | 0.241 |
| 41 | 0.245 | 0.237 | 0.242 | 0.237 |
| 42 | 0.237 | 0.235 | 0.241 | 0.235 |
| 43 | 0.238 | 0.237 | 0.234 | 0.232 |
| 44 | 0.239 | 0.239 | 0.234 | 0.234 |
| 45 | 0.237 | 0.237 | 0.230 | 0.230 |
| 46 | 0.233 | 0.236 | 0.230 | 0.233 |
| 47 | 0.233 | 0.235 | 0.230 | 0.231 |
| 48 | 0.230 | 0.233 | 0.233 | 0.239 |
| 49 | 0.242 | 0.239 | 0.239 | 0.245 |
| 50 | 0.236 | 0.240 | 0.233 | 0.240 |
| 51 | 0.235 | 0.228 | 0.234 | 0.234 |
| 52 | 0.235 | 0.240 | 0.234 | 0.236 |
| 53 | 0.236 | 0.237 | 0.239 | 0.235 |
| 54 | 0.237 | 0.239 | 0.241 | 0.235 |
| 55 | 0.237 | 0.230 | 0.228 | 0.235 |
| 56 | 0.235 | 0.240 | 0.236 | 0.239 |
| 57 | 0.240 | 0.248 | 0.228 | 0.233 |
| 58 | 0.233 | 0.237 | 0.229 | 0.240 |
| 59 | 0.241 | 0.236 | 0.233 | 0.236 |
| 60 | 0.230 | 0.230 | 0.228 | 0.237 |
| 61 | 0.238 | 0.234 | 0.235 | 0.240 |
| 62 | 0.240 | 0.236 | 0.240 | 0.238 |
| 63 | 0.233 | 0.236 | 0.227 | 0.228 |
| 64 | 0.229 | 0.238 | 0.236 | 0.233 |
| 65 | 0.247 | 0.235 | 0.237 | 0.229 |
| 66 | 0.233 | 0.235 | 0.229 | 0.234 |
| 67 | 0.235 | 0.236 | 0.233 | 0.230 |
| 68 | 0.223 | 0.231 | 0.235 | 0.235 |
| 69 | 0.232 | 0.232 | 0.229 | 0.227 |
| 70 | 0.231 | 0.233 | 0.230 | 0.233 |
| 71 | 0.236 | 0.226 | 0.235 | 0.240 |
| 72 | 0.237 | 0.235 | 0.233 | 0.233 |
| 73 | 0.231 | 0.232 | 0.233 | 0.233 |
| 74 | 0.235 | 0.236 | 0.235 | 0.237 |
| 75 | 0.237 | 0.235 | 0.238 | 0.233 |

| Plate Number/ID | 1 | 2 | 3 | 4 |
|-----------------|-------|-------|-------|-------|
| 76 | 0.233 | 0.226 | 0.234 | 0.234 |
| 77 | 0.235 | 0.229 | 0.231 | 0.228 |
| 78 | 0.231 | 0.227 | 0.233 | 0.230 |
| 79 | 0.236 | 0.247 | 0.230 | 0.233 |
| 80 | 0.228 | 0.228 | 0.233 | 0.235 |
| 81 | 0.233 | 0.232 | 0.238 | 0.240 |
| 82 | 0.234 | 0.230 | 0.228 | 0.228 |
| 83 | 0.230 | 0.237 | 0.232 | 0.235 |
| 84 | 0.230 | 0.233 | 0.230 | 0.230 |
| 85 | 0.235 | 0.236 | 0.234 | 0.234 |
| 86 | 0.231 | 0.230 | 0.234 | 0.231 |
| 87 | 0.231 | 0.229 | 0.237 | 0.235 |
| 88 | 0.237 | 0.231 | 0.236 | 0.230 |
| 89 | 0.233 | 0.231 | 0.234 | 0.229 |
| 90 | 0.229 | 0.235 | 0.231 | 0.228 |

| | |
|-----------------|--------------|
| Minimum: | 0.223 |
| Maximum: | 0.251 |



LEGEND:
 A = OUTER PONTOON SIDEWALL
 B = PONTOON BOTTOM
 C = INNER PONTOON SIDEWALL
 D = UPPER PONTOON DECK
 E = PONTOON MANWAY COVER
 F = RIM ANGLE


| | |
|---|--------------------|
|  | |
| TITLE: PONTOON UT LOCATIONS | |
| CUSTOMER: KINDER MORGAN CANADA | |
| TANK NO: 52 | JOB NO: 14-358 |
| LOCATION: KERROBERT TERMINAL | |
| SIZE: 138' 4" DIAM. | DATE: AUG 20, 2014 |
| DRAWN BY: B.S. / C.L. | PAGE: 1 OF 1 |

FIGURE 3 PONTOON LAYOUT

TABLE 11 EXTERNAL FLOATING ROOF PONTOON THICKNESS READINGS

| Pontoon Ultrasonic Thickness Readings (in inches) | | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|-------|
| Pontoon # | A | B | C | D | E | F | G | H |
| 1 | 0.196 | 0.196 | 0.223 | 0.192 | 0.210 | 0.259 | 0.223 | 0.245 |
| 2 | 0.220 | 0.227 | 0.223 | 0.199 | 0.199 | 0.257 | 0.238 | 0.250 |
| 3 | 0.215 | 0.214 | 0.216 | 0.215 | 0.187 | 0.289 | 0.226 | 0.226 |
| 4 | 0.215 | 0.220 | 0.177 | 0.189 | 0.226 | 0.288 | 0.238 | 0.244 |
| 5 | 0.166 | 0.220 | 0.218 | 0.218 | 0.191 | 0.289 | 0.237 | 0.233 |
| 6 | 0.217 | 0.216 | 0.215 | 0.224 | 0.214 | 0.291 | 0.239 | 0.242 |
| 7 | 0.221 | 0.221 | 0.222 | 0.222 | 0.211 | 0.284 | 0.233 | 0.236 |
| 8 | 0.223 | 0.224 | 0.223 | 0.224 | 0.204 | 0.278 | 0.233 | 0.255 |
| 9 | 0.226 | 0.225 | 0.225 | 0.233 | 0.198 | 0.293 | 0.247 | 0.250 |
| 10 | 0.224 | 0.224 | 0.224 | 0.228 | 0.201 | 0.289 | 0.256 | 0.229 |
| 11 | 0.223 | 0.222 | 0.219 | 0.220 | 0.208 | 0.263 | 0.251 | 0.238 |
| 12 | 0.220 | 0.220 | 0.219 | 0.220 | 0.203 | 0.269 | 0.248 | 0.242 |
| 13 | 0.224 | 0.224 | 0.223 | 0.223 | 0.210 | 0.280 | 0.228 | 0.246 |
| 14 | 0.227 | 0.225 | 0.230 | 0.227 | 0.212 | 0.259 | 0.229 | 0.247 |
| 15 | 0.218 | 0.218 | 0.184 | 0.218 | 0.213 | 0.270 | 0.226 | 0.231 |
| 16 | 0.219 | 0.217 | 0.215 | 0.216 | 0.188 | 0.262 | 0.225 | 0.225 |
| 17 | 0.217 | 0.220 | 0.220 | 0.220 | 0.197 | 0.273 | 0.223 | 0.250 |
| 18 | 0.221 | 0.218 | 0.222 | 0.221 | 0.193 | 0.275 | 0.254 | 0.228 |
| 19 | 0.221 | 0.223 | 0.219 | 0.223 | 0.192 | 0.263 | 0.229 | 0.235 |
| 20 | 0.193 | 0.184 | 0.172 | 0.221 | 0.195 | 0.277 | 0.237 | 0.244 |
| 21 | 0.212 | 0.218 | 0.222 | 0.225 | 0.194 | 0.273 | 0.228 | 0.245 |
| 22 | 0.221 | 0.217 | 0.223 | 0.221 | 0.227 | 0.257 | 0.226 | 0.242 |
| 23 | 0.221 | 0.220 | 0.228 | 0.246 | 0.187 | 0.282 | 0.226 | 0.238 |
| 24 | 0.217 | 0.218 | 0.218 | 0.227 | 0.192 | 0.300 | 0.237 | 0.245 |



PHOTOGRAPH 8 EXTERNAL FLOATING ROOF AND ROLLING LADDER



PHOTOGRAPH 9 EXTERNAL FLOATING ROOF LEG



PHOTOGRAPH 10 EXTERNAL FLOATING ROOF SEAL



PHOTOGRAPH 11 EXTERNAL FLOATING ROOF VACUUM BREAKER



PHOTOGRAPH 12 FLOATING ROOF PONTOON

5. CONCLUSIONS AND RECOMMENDATIONS

Debris on the BPP should be removed to prevent corrosion as a result of moisture being held against the tank.

Considerations for repair can be made based upon the settlement failure.

6. INSPECTION FREQUENCY AND OWNER RESPONSIBILITIES

Inspection frequency considerations as defined by API Standard 653, Section 6, paragraph 6.2.1, 6.2.2 and 6.2.3.

The inspection intervals and extent listed for routine in-service inspections are defined in API Standard 653 Section 6.3.1. These inspections can be performed by personnel who are familiar with the storage facility operations and product stored.

Inspection intervals for external inspections are listed in API Standard 653 Section 6.3.2. These inspections are to be performed by authorized inspectors at an interval not to exceed 5 years.

Inspection intervals for ultrasonic thickness inspection are listed in API Standard 653 Section 6.3.3.

Inspection intervals for internal inspections are listed in API Standard 653 Section 6.4.1. These inspections are to be performed by authorized inspectors at an interval not to exceed 20 years.

In addition to inspection frequency considerations the owner/operator is required to maintain a complete record consisting of inspection history, construction records, and repair/alteration history.

TABLE 12 INSPECTION INTERVALS FOR TANK

| Type of Inspection | Recommended Inspection Interval |
|--|---------------------------------|
| Scheduled External Inspection, by a Qualified Inspector | 5 years |
| In-service UT Thickness Survey | 5 years |
| Out-of-Service Internal Inspection (Provided the recommended repairs are completed) | |

Prepared by



Lowell Neighbour - NDE Technician

Reviewed by



Michael Pfister - API 653

APPENDIX A – API 653 IN-SERVICE INSPECTION CHECKLIST

| LEGEND | | NA = Not Applicable | NT = Not Tested or Inspected + why | NC= Not Accessible |
|--------------------------------------|---|---------------------|-------------------------------------|--------------------|
| | | SR = See Report | OK = Inspected and found acceptable | UN = Unacceptable |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | | |
| | Item | Result | Comments | |
| C.1.1 | FOUNDATION | | | |
| | Measure foundation levelness and bottom elevations (see Appendix B for extent of measurements). | SR | | |
| C.1.1.1 | Concrete Ring | | | |
| | a. Inspect for broken concrete, spalling, and cracks, particularly under backup bars used in welding butt welded annular rings under the shell. | NA | NOT PRESENT | |
| | b. Inspect drain openings in ring, back of waterdraw basins and top surface of ring for indications of bottom leakage. | NA | NOT PRESENT | |
| | c. Inspect for cavities under foundation and vegetation against bottom of tank. | NA | NOT PRESENT | |
| | d. Check that runoff rainwater from the shell drains away from tank. | OK | TANK IS ELEVATED | |
| | e. Check for settlement around perimeter of tank. | SR | SEE REPORT | |
| C.1.1.2 | Asphalt | NA | NOT PRESENT | |
| | a. Check for settling of tank into asphalt ring which would direct runoff rain water under the tank instead of away from it. | NA | NOT PRESENT | |
| | b. Look for areas where leaking of oil has left rock filler exposed, which indicates hydrocarbon leakage. | NA | NOT PRESENT | |
| C.1.1.3 | Oiled Dirt or Sand | NA | NOT PRESENT | |
| | Check for settlement into the base which would direct runoff rain water under the tank rather than away from it. | NA | NOT PRESENT | |
| C.1.1.4 | Rock | NA | NOT PRESENT | |
| | Presence of crushed rock under the steel bottom usually results in severe underside corrosion. Make a note to do additional bottom plate examination (ultrasonic, hammer testing, or turning of coupons) when the tank is out of service. | NA | NOT PRESENT | |

| | | | | |
|---|--|--|---|---|
| LEGEND | | NA = Not Applicable SR = See Report | NT = Not Tested or Inspected + why OK = Inspected and found acceptable | NC= Not Accessible UN = Unacceptable |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | | |
| | Item | Result | Comments | |
| C.1.1.5 | Site Drainage | | | |
| | a. Check Site for drainage away from the tank and associated piping and manifolds. | OK | WATER MOVES AWAY FROM EQUIPMENT | |
| | b. Check operating condition of the dike drains. | OK | OPS SAY IT WORKS | |
| C.1.1.6 | Housekeeping | | | |
| | Inspect the area for buildup of trash, vegetation, and other inflammables buildup. | OK | MINOR VEG IN BERM, | |
| C.1.2 | SHELLS | | | |
| C.1.2.1 | External Visual Inspection | | | |
| | a. Visually inspect for paint failures, pitting, and corrosion. | OK | MINOR PAINT FAILURES | |
| | b. Clean off the bottom angle area and inspect for corrosion and thinning on plate and weld. | OK | NO CORROSION | |
| | c. Inspect the bottom-to-foundation seal, if any. | NT | NO SEAL | |
| C.1.2.2 | Internal (Floating Roof Tank) | NA | NOT PRESENT | |
| | Visually inspect for grooving, corrosion, pitting, and coating failures. | NA | NOT PRESENT | |
| C.1.2.3 | Riveted Shell Inspection | NA | NOT PRESENT | |
| | a. Inspect external surface for rivet and seam leaks. | NA | NOT PRESENT | |
| | b. Locate leaks by sketch or photo (location will be lost when shell is abrasive cleaned for painting). | NA | NOT PRESENT | |
| | c. Inspect rivets for corrosion loss and wear. | NA | NOT PRESENT | |
| | d. Inspect vertical seams to see if they have been full fillet lap welded to increase joint efficiency. | NA | NOT PRESENT | |
| | e. If no record exists of vertical riveted seams, dimension and sketch (or photograph) the rivet pattern: number of rows, rivet size, pitch length, and note whether the joint is butt riveted or lap riveted. | NA | NOT PRESENT | |

| LEGEND | | | |
|---|---|-------------------------------------|--------------------|
| NA = Not Applicable | | NT = Not Tested or Inspected + why | NC= Not Accessible |
| SR = See Report | | OK = Inspected and found acceptable | UN = Unacceptable |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | |
| | Item | Result | Comments |
| C.1.2.4 | Wind Girder (Floating Roof Tanks) | | |
| | a. Inspect wind girder and handrail for corrosion damage (paint failure, pitting, corrosion product buildup), especially where it occurs at tack welded junction, and for broken welds. | OK | NONE OBSERVED |
| | b. Check support welds to shell for pitting, especially on shell plates. | OK | NONE OBSERVED |
| | c. Note whether supports have reinforcing pads welded to shell. | OK | NO REPADS |
| C.1.3 | SHELL APPURTENANCES | | |
| C.1.3.1 | Manways and Nozzles | | |
| | a. Inspect for cracks or signs of leakage on weld joint at nozzles, manways, and reinforcing plates. | OK | NONE OBSERVED |
| | b. Inspect for shell plate dimpling around nozzles, caused by excessive pipe deflection. | OK | MINOR DIMPLING |
| | c. Inspect for flange leaks and leaks around bolting. | OK | MINOR STAINING |
| | d. Inspect sealing of insulation around manways and nozzles. | NA | NO INSULATION |
| | e. Check for inadequate manway flange and cover thickness on mixer manways. | OK | ADEQUATE THICKNESS |
| C.1.3.2 | Tank Piping Manifolds | NA | NOT PRESENT |
| | a. Inspect manifold piping, flanges, and valves for leaks. | NA | NOT PRESENT |
| | b. Inspect fire fighting system components. | NA | NOT PRESENT |
| | c. Check for anchored piping which would be hazardous to the tank shell or bottom connections during earth movements. | NA | NOT PRESENT |
| | d. Check for adequate thermal pressure relief of piping to the tank. | NA | NOT PRESENT |
| | e. Check operation of regulators for tanks with purge gas systems. | NA | NOT PRESENT |
| | f. Check sample connections for leaks and for proper valve operation. | NA | NOT PRESENT |

| LEGEND | | | |
|---|--|-------------------------------------|--------------------|
| NA = Not Applicable | | NT = Not Tested or Inspected + why | NC= Not Accessible |
| SR = See Report | | OK = Inspected and found acceptable | UN = Unacceptable |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | |
| | Item | Result | Comments |
| | g. Check for damage and test the accuracy of temperature indicators. | NA | NOT PRESENT |
| | h. Check welds on shell-mounted davit clips above valve 6 inches and larger. | NA | NOT PRESENT |
| C.1.3.3 | Autogauge System | NA | NOT PRESENT |
| | a. Inspect autogauge tape guide and lower sheave housing (floating swings) for leaks. | NA | NOT PRESENT |
| | b. Inspect autogauge head for damage. | NA | NOT PRESENT |
| | c. Bump the checker on autogauge head for proper movement of tape. | NA | NOT PRESENT |
| | d. Identify size and construction material of autogauge tape guide (floating roof tanks). | NA | NOT PRESENT |
| | e. Ask operator if tape tends to hang up during tank roof movement (floating roof tanks). | NA | NOT PRESENT |
| | f. Compare actual product level to the reading on the autogauge (maximum variation is 2 inches). | NA | NOT PRESENT |
| | g. On floating roof tanks, when the roof is in the lowest position, check that no more than two feet of tape are exposed at the end of the tape guide. | NA | NOT PRESENT |
| | h. Inspect condition of board and legibility of board-type autogauges. | NA | NOT PRESENT |
| | i. Test freedom of movement of marker and float. | NA | NOT PRESENT |
| C.1.3.4 | Shell-Mounted Sample Station | NA | NOT PRESENT |
| | a. Inspect sample lines for function of valves and plugging of lines, including drain or return-to-tank line. | NA | NOT PRESENT |
| | b. Check circulation pump for leaks and operating problems. | NA | NOT PRESENT |
| | c. Test bracing and supports for sample lines and equipment. | NA | NOT PRESENT |
| C.1.3.5 | Heater (Shell Manway Mounted) | NA | NOT PRESENT |
| | Inspect condensate drain for presence of oil indicating leakage. | NA | NOT PRESENT |

| LEGEND | | | |
|---|--|-------------------------------------|--------------------|
| NA = Not Applicable | | NT = Not Tested or Inspected + why | NC= Not Accessible |
| SR = See Report | | OK = Inspected and found acceptable | UN = Unacceptable |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | |
| | Item | Result | Comments |
| C.1.3.6 | Mixer | | |
| | a. Inspect for proper mounting flange and support. | OK | NONE OBSERVED |
| | b. Inspect for leakage. | OK | NONE OBSERVED |
| | c. Inspect condition of power lines and connections to mixer. | OK | NO DAMAGES |
| C.1.3.7 | Swing Lines: Winch Operation | NA | NOT PRESENT |
| | a. Nonfloating. Raise, then lower the swing line with the winch, and check for cable tightness to confirm that the swing line lowered properly. | NA | NOT PRESENT |
| | b. Floating. With tank half full or more, lower the swing line, then let out cable and check if swing has pulled cable tight, indicating that the winch is operating properly. | NA | NOT PRESENT |
| | c. Indicator. Check that the indicator moves in the proper direction. Floating swing line indicators show a lower level as cable is wound up on the winch. Non-floating swing line indicators show the opposite. | NA | NOT PRESENT |
| C.1.3.8 | Swing Lines: External Guide System | NA | NOT PRESENT |
| | Check for leaks at threaded and flanged joints. | NA | NOT PRESENT |
| C.1.3.9 | Swing Lines: Identify Ballast Varying Need | NA | NOT PRESENT |
| | Check for significant difference in stock specific gravity. | NA | NOT PRESENT |
| C.1.3.10 | Swing Lines: Cable Material and Condition | NA | NOT PRESENT |
| | a. For non-stainless steel cable, check for corrosion over entire length. | NA | NOT PRESENT |
| | b. All cable: check for wear or fraying. | NA | NOT PRESENT |
| C.1.3.11 | Swing Lines: Product Sample Comparison | NA | NOT PRESENT |
| | Check for water or gravity differences that would indicate a leaking swing joint. | NA | NOT PRESENT |
| C.1.3.12 | Swing Lines: Target | NA | NOT PRESENT |
| | Target should indicate direction of swing opening (up or down) and height above bottom where suction will be lost with swing on bottom | | |

| LEGEND | | | |
|--------------------------------------|---|-------------------------------------|---------------------------|
| NA = Not Applicable | | NT = Not Tested or Inspected + why | |
| SR = See Report | | OK = Inspected and found acceptable | |
| | | NC= Not Accessible | |
| | | UN = Unacceptable | |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | |
| | Item | Result | Comments |
| | support. | | |
| C.1.4 | ROOFS | | |
| C.1.4.1 | Deck Plate Internal Corrosion | | |
| | For safety, before accessing the roof, check with ultrasonic instrument or lightly use a ball peen hammer to test the deck plate near the edge of the roof for thinning. (corrosion normally attacks the deck plate at the edge of a fixed roof and at the rafters in the center of the roof first.) | OK | UT PERFORMED NO CORROSION |
| C.1.4.2 | Deck Plate External Corrosion | | |
| | Visually inspect for paint failure, holes, pitting, and corrosion product on the roof deck. | OK | NO CORROSION |
| C.1.4.3 | Roof Deck Drainage | | |
| | Look for indication of standing water. (Significant sagging of fixed roof deck indicates potential rafter failure. Large standing water areas on a floating roof indicate inadequate drainage design or, if to one side, a nonlevel roof with possible leaking pontoons.) | OK | DRAIN WORKS |
| C.1.4.4 | Level of Floating Roof | | |
| | At several locations, measure distance from roof rim to a horizontal weld seam above the roof. A variance in the readings indicates a nonlevel roof with possible shell out-of-round, out-of-plumb, leaking pontoons, or hang-up. On small diameter tanks, an unlevel condition can indication unequal loading at that level. | NT | TANK LEVEL STATIC |
| C.1.4.5 | Gas Test Internal Floating Roof | NA | NOT PRESENT |
| | Test for explosive gas on top of the internal floating roof. Readings could indicate a leaking roof, leaking seal system, or inadequate ventilation of the area above the internal floating roof. | NA | NOT PRESENT |
| C.1.4.6 | Roof Insulation | NA | NOT PRESENT |
| | a. Visually inspect for cracks or leaks in the insulation weather coat where runoff rain water could penetrate the insulation. | NA | NOT PRESENT |

| LEGEND | | | |
|--------------------------------------|---|-------------------------------------|---------------------------|
| NA = Not Applicable | | NT = Not Tested or Inspected + why | |
| SR = See Report | | OK = Inspected and found acceptable | |
| | | NC= Not Accessible | |
| | | UN = Unacceptable | |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | |
| | Item | Result | Comments |
| | b. Inspect for wet insulation under the weather coat. | NA | NOT PRESENT |
| | c. Remove small test sections of insulation and check for corrosion and holes near the edge of the insulated area. | NA | NOT PRESENT |
| C.1.4.7 | Floating Roof Seal Systems | NA | NOT PRESENT |
| | a. Measure and record maximum seal-to-shell gaps at: | NA | NOT PRESENT |
| | 1. Low pump out. | NA | NOT PRESENT |
| | 2. Mid-shell. | NA | NOT PRESENT |
| | 3. High liquid level. | NA | NOT PRESENT |
| | b. Measure and record annular space at 30 foot spacing (minimum of four quadrants) around roof and record. Measurements should be taken in directly opposite pairs. | NA | NOT PRESENT |
| | 1. _____ Opposite pair 1. | NA | NOT PRESENT |
| | 2. _____ Opposite pair 2. | NA | NOT PRESENT |
| | c. Check if seat fabric on primary shoe seals is pulling shoes away from shell (fabric not wide enough). | OK | NOT OBSERVED |
| | d. Inspect fabric for deterioration, holes, tears, and cracks. | NT | EXCESSIVE PRODUCT PRESENT |
| Q | e. Inspect visible metallic parts for corrosion and wear. | OK | NONE OBSERVED |
| | f. Inspect for openings in seals that would permit vapor emissions. | OK | GAPS IN SECONDARY NOTED |
| | g. Inspect for protruding bolt or rivet heads against the shell. | OK | NONE OBSERVED |
| | h. Pull both primary and secondary seal systems back all around the shell to check their operation. | OK | SECONDARYONLY TESTED |
| | i. Inspect secondary seals for signs of buckling or indications that their angle with the shell is too shallow. | OK | MINOR DAMAGES ONLY |
| | j. Inspect wedge-type wiper seals for flexibility, resilience, cracks, and tears. | NA | NOT WEDGE TYPE |

| | | | | |
|---|--|---------------------|-------------------------------------|--------------------|
| LEGEND | | NA = Not Applicable | NT = Not Tested or Inspected + why | NC= Not Accessible |
| | | SR = See Report | OK = Inspected and found acceptable | UN = Unacceptable |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | | |
| | Item | Result | Comments | |
| C.1.5 | ROOF APPURTENANCES | | | |
| C.1.5.1 | Sample Hatch | | | |
| | a. Inspect condition and functioning of sample hatch cover. | OK | WORKING ORDER | |
| | b. On tanks governed by Air Quality Monitoring District rules, check for the condition of seal inside hatch cover. | NA | NOT GOVERNED | |
| | c. Check for corrosion and plugging on thief and gauge hatch cover. | OK | NO CORROSION IN HATCG | |
| | d. Where sample hatch is used to reel gauge stock level, check for marker and tab stating hold off distance. | NA | NOT USED TO REEL | |
| | e. Check for reinforcing pad where sample hatch pipe penetrates the roof deck. | OK | PAD PRESENT | |
| | f. On floating roof sample hatch and recoil systems, inspect operation of recoil reel and condition of rope. | NA | NO RECOIL SYSTEM | |
| | g. Test operation of system. | NA | NO SYSTEM | |
| | h. On ultra clean stocks such as JP4, check for presence and condition of protective coating or liner inside sample hatch (preventing rust from pipe getting into sample). | NA | NOT CLEAN STOCK | |
| C.1.5.2 | Gauge Well | | | |
| | a. Inspect visible portion of the gauge well for thinning, size of slots, and cover condition. | OK | GOOD CONDITION | |
| | b. Check for hold off distance marker and tab with hold off distance (legible). | OK | TAB PRESENT | |
| | c. On floating roofs, inspect condition of roof guide for gauge well, particularly the condition of the rollers for grooving. | OK | GUIDE SYSTEM IS GOOD | |
| | d. If accessible, check the distance from the gauge well pipe to the tank shell at different levels. | NT | NOT ACCESSIBLE | |
| | e. If tank has a gauge well washer, check valve for leakage and for presence of a bull plug or blind flange. | NA | NO WASHER | |

| LEGEND | | | |
|--------------------------------------|---|-------------------------------------|-------------|
| NA = Not Applicable | | NT = Not Tested or Inspected + why | |
| SR = See Report | | OK = Inspected and found acceptable | |
| | | NC= Not Accessible | |
| | | UN = Unacceptable | |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | |
| | Item | Result | Comments |
| C.1.5.3 | Fixed Roof Scaffold Support | NA | NOT PRESENT |
| | Inspect scaffold support for corrosion, wear, and structural soundness. | NA | NOT PRESENT |
| C.1.5.4 | Autogauge: Inspection Hatch and Guides (Fixed Roof) | NA | NOT PRESENT |
| | a. Check the hatch for corrosion and missing bolts. | NA | NOT PRESENT |
| | b. Look for corrosion on the tape guide’s and float guide’s wire anchors. | NA | NOT PRESENT |
| C.1.5.5 | Autogauge: Float Well Cover | NA | NOT PRESENT |
| | a. Inspect for corrosion. | NA | NOT PRESENT |
| | b. Check tape cable for wear or fraying caused by rubbing on the cover. | NA | NOT PRESENT |
| C.1.5.6 | Sample Hatch (Internal Floating Roof) | NA | NOT PRESENT |
| | a. Check overall conditions. | NA | NOT PRESENT |
| | b. When equipped with a fabric seal, check for automatic sealing after sampling. | NA | NOT PRESENT |
| | c. When equipped with recoil reel opening device, check for proper operations. | NA | NOT PRESENT |
| C.1.5.7 | Roof-Mounted Vents (Internal Floating Roof) | NA | NOT PRESENT |
| | Check condition of screens, locking and pivot pins. | NA | NOT PRESENT |
| C.1.5.8 | Gauging Platform Drip Ring | NA | NOT PRESENT |
| | On fixed roof tanks with drip rings under the gauging platform or sampling area, inspect for plugged drain return to the tank. | NA | NOT PRESENT |
| C.1.5.9 | Emergency Roof Drains | NA | NOT PRESENT |
| | Inspect vapor plugs for emergency drain: that seal fabric discs are slightly smaller than the pipe ID and that fabric seal is above the liquid level. | NA | NOT PRESENT |
| C.1.5.10 | Removable Roof Leg Racks | NA | NOT PRESENT |
| | Check for leg racks on roof. | NA | NOT PRESENT |

| | | | | |
|---|---|---------------------|-------------------------------------|--------------------|
| LEGEND | | NA = Not Applicable | NT = Not Tested or Inspected + why | NC= Not Accessible |
| | | SR = See Report | OK = Inspected and found acceptable | UN = Unacceptable |
| TANK IN-SERVICE INSPECTION CHECKLIST | | | | |
| | Item | Result | Comments | |
| C.1.5.11 | Vacuum Breakers | | | |
| | Report size, number, and type of vacuum breakers. Inspect vacuum breakers. If high legs are set, check for setting of mechanical breaker in high leg position. | SR | NOTED IN ROOF NOTES | |
| C.1.5.12 | Rim Vents | NA | NOT PRESENT | |
| | a. Check condition of the screen on the rim vent cover. | NA | NOT PRESENT | |
| | b. Check for plating off or removal or rim vents where jurisdictional rules do not permit removal. | NA | NOT PRESENT | |
| C.1.5.13 | Pontoon Inspection Hatches | | | |
| | a. Open pontoon inspection hatch covers and visually check inside for pontoon leakage. | Ok | NO CONCERNS | |
| | b. Test for explosive gas (an indicator of vapor space leaks). | OK | NONE OBSERVED | |
| | c. If pontoon hatches are equipped with locked down coves, check for vent tubes. Check that vent tubes are not plugged up. Inspect lock down devices for condition and operation. | NA | NO LOCKDOWNS | |

APPENDIX B – EQUIPMENT LIST AND CREW CERTIFICATIONS

| Name | Position | Certification |
|------------------|-------------------|---------------|
| Mike Pfister | API 653 Inspector | #28596 |
| Brian Boulet | API 653 Inspector | #30213 |
| Lowell Neighbour | NDE Technician | SNT MT2/UT1 |

| Equipment Used | Serial Number | Last Calibration Date |
|----------------------------------|------------------|--|
| MFE Floor Scanner | 1007115 | Qualified prior to use by test plate |
| MFE Floor Scanner Stop on Defect | 0529004 | Qualified prior to use by test plate |
| Panametrics EPOCH IV | 071538005 | January 2011 |
| MPI Yoke | 43530 | Qualified prior to use by test weight |
| MPI 10 lb Calibration block | Lot #:502 | N/A |
| Tri-pod Tank Climber | 88218 | N/A |
| Settlement Head | 55000083 | N/A |
| Coating Gauge | 609844 | N/A |
| Volumetric Strap Tape(2) | CS06737/CS06736 | June 24,2007 |
| Holiday Tester | 170707 | Qualified prior to use by DC Crest Meter |
| Gauge Tape &Plumb(2) | CS06745/CS06745M | June 24,2007 |

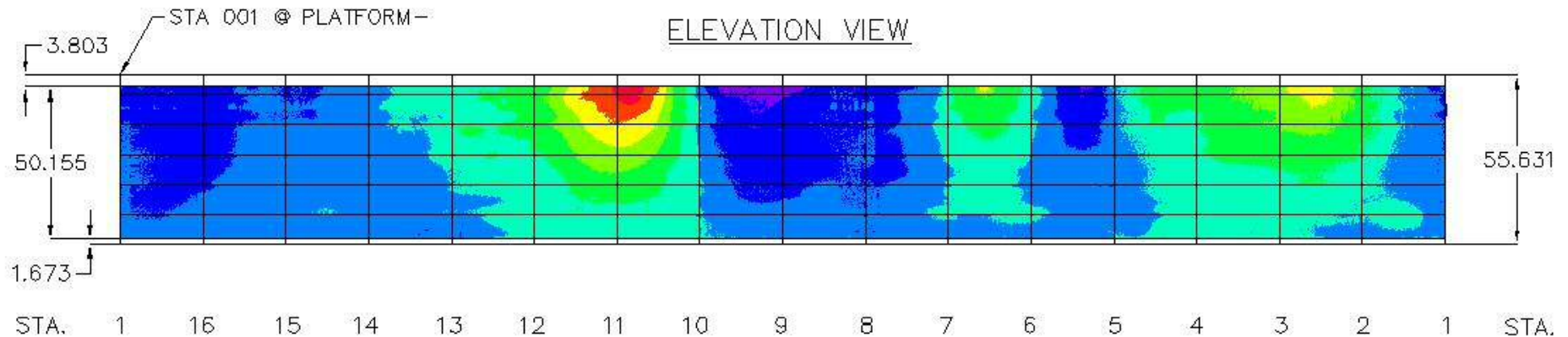
Enbridge Pipelines Inc.
Kerrobert Terminal
Tank #52
August 20, 2014



APPENDIX C – SHELL CONTOUR MAP

TANK NO. 52
TANK SHELL CONTOUR
ENBRIDGE PIPELINES
KERROBERT, SK

ELEVATION VIEW



| Radii Table | | | |
|--------------------|--------------------|---------|-------------|
| Minimum Radii (Ft) | Maximum Radii (Ft) | Area | Color |
| 68.70 | 68.78 | 46.28 | Red |
| 68.78 | 68.87 | 158.95 | Orange |
| 68.87 | 68.96 | 363.53 | Yellow |
| 68.96 | 69.04 | 817.75 | Light Green |
| 69.04 | 69.13 | 2400.71 | Green |
| 69.13 | 69.21 | 5958.73 | Cyan |
| 69.21 | 69.30 | 8500.04 | Blue |
| 69.30 | 69.38 | 3476.91 | Dark Blue |
| 69.38 | 69.47 | 115.90 | Purple |

NOTES:

1. ALL MEASUREMENTS ARE IMPERIAL FT.
2. APPROXIMATE BEARING OF STATION #1 IS ALIGNED WITH PLATFORM.
3. STATION SPACING IS CLOCKWISE @ 27.181 FT. (TYP).
4. DENSITY OF RADIUS POINTS IS APPROXIMATELY 24 POINTS PER SQ FT.



**TANK NO. 52
TANK SHELL CONTOUR
MAP**

REVISIONS

| NO. | BY | DATE | DESCRIPTION |
|-----|----|----------------|--------------------------------|
| 1 | RS | SEPT. 28, 2014 | INITIAL TANK SHELL CONTOUR MAP |
| | | | |
| | | | |

ENBRIDGE PIPELINES

CONTACT: MIKE PFISTER

KERROBERT, SK

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