

# Holding Pond Annual Inspection Report

Marquette Board of Light and Power  
Shiras Steam Plant

Project Number: 60445171

January 12, 2018

Prepared for:

Marquette Board of Light and Power  
Shiras Steam Plant  
Marquette, Michigan

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## 1. Introduction

This report has been prepared to satisfy the 40 CFR 257.83 annual inspection requirements for surface water impoundments as specified in the Coal Combustion Residual (CCR) Rule published on April 17, 2015 for the Marquette Board of Light and Power (MBLP) Shiras Steam Plant located in the City of Marquette, Michigan. The plant has one CCR surface water impoundment, which is a holding pond (WDS ID# 478988) located on the north side of the plant property on the shore of Lake Superior. AECOM performed the initial annual inspection of this impoundment under the CCR Rule and provided a report dated January 15, 2016. AECOM also performed the next annual inspection and provided a report dated January 12, 2017.

## 2. Annual Inspection

### 2.1 Holding Pond Configuration

The holding pond is composed of 5 cells which are enclosed by steel sheet pile walls. Its overall configuration is shown in Drawing 1 in Appendix A, and an overall view is shown in Photo 1 in Appendix C. It has been expanded and modified a number of times since constructed. The south and west boundaries of the holding pond are formed by the shoreline of the lake. The east and north boundaries of the holding pond are formed by sheet pile walls which were constructed in 1981. Because of the poor condition of the original north wall, an additional wall was constructed to replace it in 2013. The new wall was placed inside of the original existing north wall, which remains but no longer provides containment (Photo 3 in Appendix C). The walls for the inner cells 1, 2, and 3 were constructed in 1990. There are also some abandoned sheet pile walls in place from previous configurations. The last change to the pond configuration was the addition of the north sheet pile wall in 2013 mentioned above.

The original 1981 construction drawings and 1990 improvement drawings were reviewed as part of this inspection. We also reviewed the report AECOM provided for the structural inspection of the impoundment which we performed in 2013 as well as the report from our initial annual inspection performed in 2015 and follow-up annual inspection performed in 2016.

There are several ramps on the south shore of the impoundment which allow loaders to enter the cells to remove solids which have settled out of the impounded water. The cells are periodically drained to allow this cleanout operation. The residuals are primarily composed of bottom ash but also contain components from other waste streams including coal pile runoff and storm water. The residuals are removed to an off-site landfill.

### 2.2 Instrumentation

Water levels in the holding pond cells are monitored by measuring down from points of known elevation on the cell access walkways. The location and elevation of each measure down point (M.D.P.) is shown on Drawing 1 in Appendix A. The elevations were determined by an AECOM survey crew during our initial annual inspection on October 15, 2015.

Movement monitoring targets were also installed during the October 15, 2015 survey work. These reflectorized targets were installed near the top of the sheet pile walls at the locations shown on Drawing 1 in Appendix A. Initial coordinates of each target were determined using a total station laser survey instrument set-up over 2 control points which were established on the south and west shores of the pond. The current coordinates of the targets were checked by an AECOM survey crew on December 15, 2017. The majority of the sheet pile walls showed no significant lateral movement or settlement. This is a good indication that the sheet pile walls are generally stable.

Targets 6 and 7 showed a small but detectable amount a lateral movement. These targets are located on the interior sheet pile wall between cells 1 and 2. Although the lateral movement is relatively small (1.2" maximum), it is about two times the movement which was detected in our previous annual report. This indicates the wall may be slowly starting to shift laterally. This is viewed as a minor finding since the movement is small, the interior walls are not critical for containment of the CCR residuals, and the perimeter sheet pile containment walls do not show any signs of significant movement. Although the sheetpile wall is in poor condition, the lateral movement is not visually apparent and there does not appear to be any distress to the walkway mounted on top of the wall. We suggest continued monitoring of the points during subsequent annual inspections.

## 2.3 Water and CCR Ash Elevations

The water elevation in each of the cells is monitored periodically using the system described in section 2.2 of this report. The following table summarizes the variation in water elevations during the 2017 calendar year:

Cell	Minimum Elevation	Maximum Elevation	Present Elevation on 12/01/2017
1	605.55	607.71	607.56
2	603.81	608.00	608.00
3	607.26	607.80	607.77
4	606.23	607.65	606.85
5	606.17	606.95	606.29

The elevation of the CCR ash deposit surface varies between cells. The ash surface elevation also varies across each cell and cannot be characterized by a single elevation. Water depth elevations to the top of the ash deposits were measured by AECOM from a boat on December 1, 2017. Cross sections of each cell showing the CCR ash bottom profiles were developed using these measurements and are included in Drawings 2 through 6 in Appendix A.

## 2.4 Storage Capacity

The storage capacity of the holding pond was calculated using the original design elevation of the pond bottom as the lower limit of the enclosed volume. The upper limit was assumed to be the current elevation of the outlet weir in each cell. The total storage volume was calculated to be 5,799 cubic yards. The calculations are included in Appendix B.

## 2.5 Current Volume of Impounded Water and CCR

The water depth measurements from our survey were used to calculate the current upper limit of CCR ash in the holding pond. The lower limit of CCR ash was assumed to be the original design elevation of the bottom of the pond. The volume of CCR ash was calculated to be 2,390 cubic yards. The calculations for the CCR ash volume are included in Appendix B.

The volume of impounded water was calculated using the results of our water depth survey for the lower limit of the water. The upper limit was assumed to be the current outlet weir elevation of each cell. The volume of impounded water was calculated to be 3,409 cubic yards. The calculations for the impounded water volume are included in Appendix B.

## 2.6 Structural Field Evaluation

The primary structural component of the holding pond is the exterior sheet pile walls on the east and north sides of the pond. A field evaluation of the outer sheet pile containment wall was performed on December 2, 2016 by AECOM employees, Brian Hintsala, P.E. and Bruce Peterson. The water was at normal elevation in all of the cells during the inspection. A boat was used to inspect the north and east walls, which separate the holding pond from Lake Superior.

Based on our field observations, this sheet pile used for this wall is a hot rolled Z-shaped section with a depth of 12-inches and a 3/8-inch nominal thickness. It appears to be similar to a PZ27 sheet pile section, which is a common type of sheet pile.

The steel surface on the Lake Superior side of the east sheet pile was bare and the majority of the wall appeared to be in good condition (Photo 2 in Appendix C). The north wall is newer and in very good condition. There were a number of spots of localized corrosion which occurred primarily at the joints between the sheets (Photos 4 and 5 in Appendix C). Most of these had an appearance that suggested there may have been seepage through the joint at one time. No seepage was evident during this evaluation.

During our initial annual inspection performed in November of 2015, thickness measurements were taken in order to get an overall view of the condition of the wall. Generally speaking, the readings varied from 0.33-inches to 0.40-inches, indicating little to no loss of the original 3/8-inch steel thickness. There are small areas of more severe localized corrosion (Photo 5 in Appendix C). We would regard this amount of steel loss as non-critical, since they are small 2-inch to 3-inch wide areas and will not materially reduce the structural capacity of the wall. In addition, our structural analysis of the wall performed in 2013 showed that this exterior wall had a large margin of reserve strength and could tolerate over 50% loss of steel thickness due to corrosion.

The remaining sheet pile walls which form the internal boundaries between the cells are constructed of a lighter gage sheet pile. It was not possible to examine these walls closely because the cells were full of water and the walls were mostly submerged. The exposed portions appear to be in poor condition. These internal walls, however, do not affect to the structural ability of the pond to contain CCR ash and are only used as baffles to improve the settlement of ash out of the water. Some minor lateral movement was detected to the interior wall between cells 1 and 2. This is viewed as a non-critical for the reasons discussed above in section 2.2.

### 3. Conclusion

The south and west sides of the holding pond are incised into the ground and pose no threat of failure, resulting in a release of CCR materials. The east steel sheet pile wall of the holding pond is currently in fairly good condition and has a good reserve of structural bending capacity. A new heavy gage sheet pile wall was installed in 2013 to replace the deteriorated north wall of the holding pond and is in very good condition. The north and east sheet pile wall both appear to be stable and have ample structural capacity to contain the impounded water. The interior sheet pile walls are in poor condition, but are not required for containment integrity of the holding pond. The interior walls can continue to function in this condition as separators between the cells to improve the settlement of solids out of the process water.



## Appendix A Report Drawings

DATE OF SURVEY: DECEMBER 15, 2017  
 ELEVATION DATUM IS NAVD88 AND ESTABLISHED BY DIFFERENTIAL LEVEL LOOP FROM NGS DISK LSC7863 (RK0415) WHICH HAS A PUBLISHED ELEVATION OF 615.610.  
 REFLECTIVE TARGET COORDINATES AND ELEVATIONS ESTABLISHED BY TURNING 2 SETS OF ANGLES FROM CONTROL POINTS 1 AND 2.  
 TARGET BENCHMARK ELEVATIONS ESTABLISHED BY DIFFERENTIAL LEVELING. SOME TARGET BENCHMARKS WERE INACCESSIBLE TO A LEVEL ROD AND HAD TO BE MEASURED DOWN TO FROM ABOVE.

Point	10/15/2015 NORTHING	10/15/2015 EASTING	11/22/2016 NORTHING	11/22/2016 EASTING	12/15/2017 NORTHING	12/15/2017 EASTING	DELTA NORTHING	DELTA EASTING
1	5000.000	5000.000	5000.000	5000.000	5000.000	5000.000	0.000	0.000
2	5023.395	4885.493	5023.395	4885.493	5023.395	4885.493	0.000	0.000
3	5022.542	4987.579	5022.542	4987.579	5022.571	4987.574	0.029	-0.005
4	5076.237	4960.903	5076.230	4960.876	5076.229	4960.892	0.002	-0.011
5	5124.911	4931.078	5124.911	4931.083	5124.909	4931.078	-0.002	0.000
6	5049.888	5011.443	5049.886	5011.409	5049.887	5011.386	-0.021	-0.058
7	5089.939	4987.426	5089.900	4987.363	5089.887	4987.325	-0.052	-0.101
8	5138.743	4957.889	5138.738	4957.866	5138.736	4957.858	-0.007	-0.011
9	5135.519	4922.879	5135.518	4922.877	5135.526	4922.881	0.007	0.002
10	5157.940	4943.954	5157.940	4943.955	5157.948	4943.955	0.008	0.001
11	5182.039	4966.800	5182.039	4966.799	5182.044	4966.800	0.005	0.000
12	5202.884	4986.818	5202.842	4986.813	5202.848	4986.811	0.006	-0.007
13	5212.475	5003.007	5212.463	5003.001	5212.473	5003.019	0.012	0.008
14	5181.111	5020.604	5181.103	5020.619	5181.117	5020.630	0.006	0.005
15	5151.909	5036.356	5151.908	5036.367	5151.917	5036.354	0.008	-0.002
16	5126.503	5050.227	5126.501	5050.237	5126.505	5050.226	0.002	-0.001
17	5099.988	5064.660	5099.986	5064.666	5099.995	5064.659	0.007	-0.001
18	5080.634	5075.118	5080.635	5075.124	5080.632	5075.125	-0.002	0.007
19	5048.539	5048.415	5048.536	5048.413	5048.538	5048.412	-0.001	-0.003
20	5104.626	5013.673	5104.625	5013.695	5104.644	5013.690	0.016	0.017
21	5153.524	4983.690	5153.518	4983.703	5153.519	4983.689	-0.005	-0.001

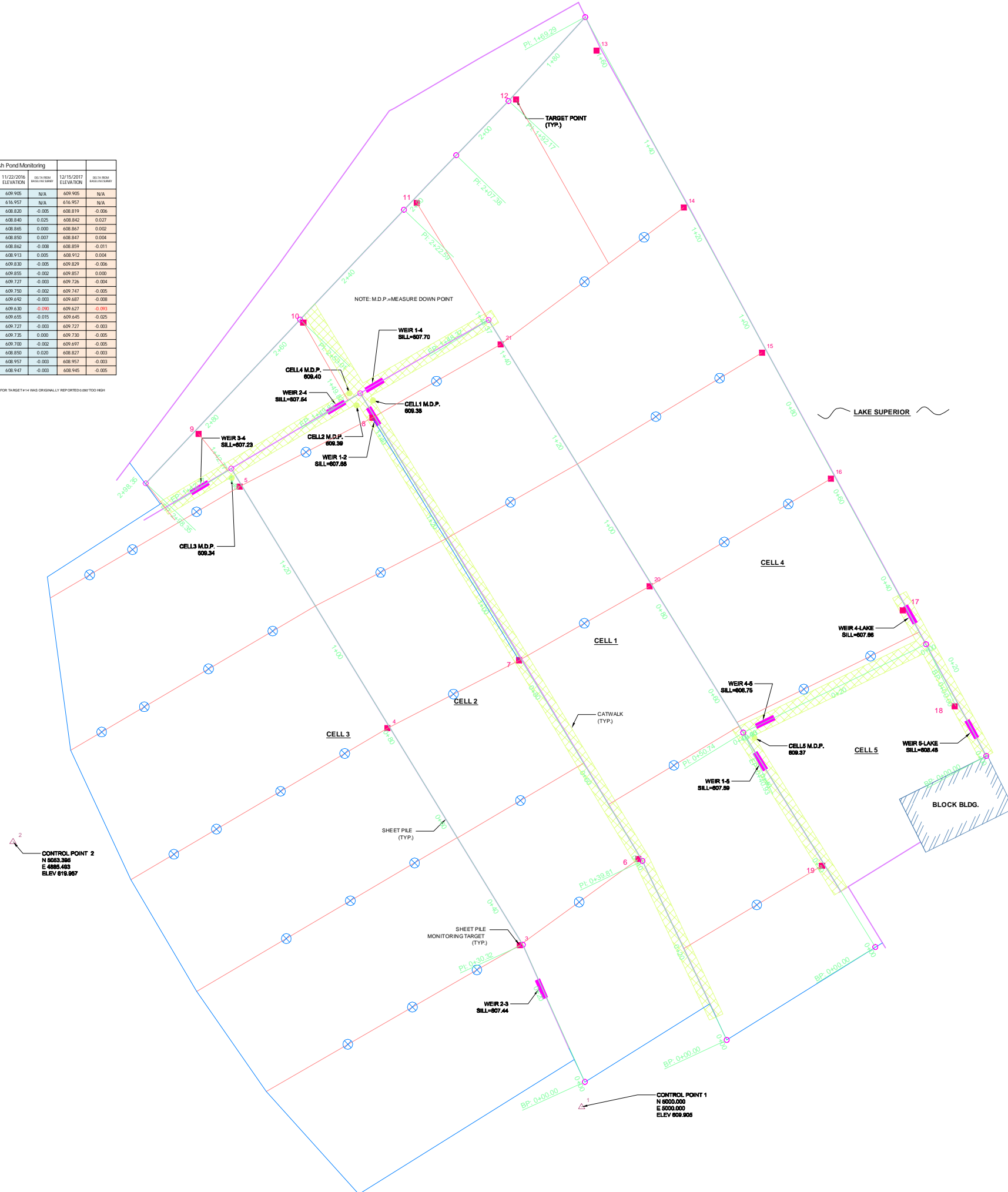
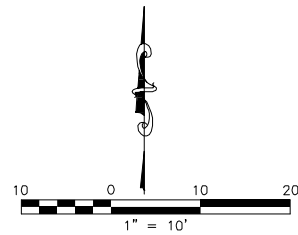
POINT	10/15/2015 ELEVATION	11/22/2016 ELEVATION	12/15/2017 ELEVATION	DELTA ELEVATION
1	609.905	609.905	N/A	609.905
2	616.957	616.957	N/A	616.957
3	608.825	608.820	-0.005	608.819
4	608.815	608.840	0.025	608.842
5	608.885	608.885	0.000	608.887
6	608.843	608.850	0.007	608.847
7	608.870	608.862	-0.008	608.859
8	608.908	608.913	0.005	608.912
9	609.835	609.830	-0.005	609.829
10	609.857	609.855	-0.002	609.857
11	609.730	609.727	-0.003	609.726
12	609.752	609.750	-0.002	609.747
13	609.695	609.692	-0.003	609.687
14	609.720	609.630	-0.090	609.627
15	609.810	609.835	0.025	609.843
16	609.730	609.727	-0.003	609.727
17	609.735	609.735	0.000	609.730
18	609.702	609.700	-0.002	609.697
19	608.830	608.850	0.020	608.827
20	608.940	608.957	0.017	608.957
21	608.930	608.947	0.017	608.945

NOTE: 2015 ELEVATION FOR TARGET #14 WAS ORIGINALLY REPORTED AS 608.700 HIGH

TYPICAL TARGET INSTALLATION



TARGET COORDINATE AND ELEVATION  
 BENCHMARK ELEVATION



Rev	Date	Description
R-2	BDP 12/1/2017	2017 ANNUAL INSPECTION
R-1	BDP 12/15/2016	2016 ANNUAL INSPECTION

Designed: CLC 10/19/2015  
 Drawn: CLC 10/19/2015  
 Checked: GH XX/XX/2008  
 Approved: JKL XX/XX/2008

PROJECT NUMBER  
**60445171**

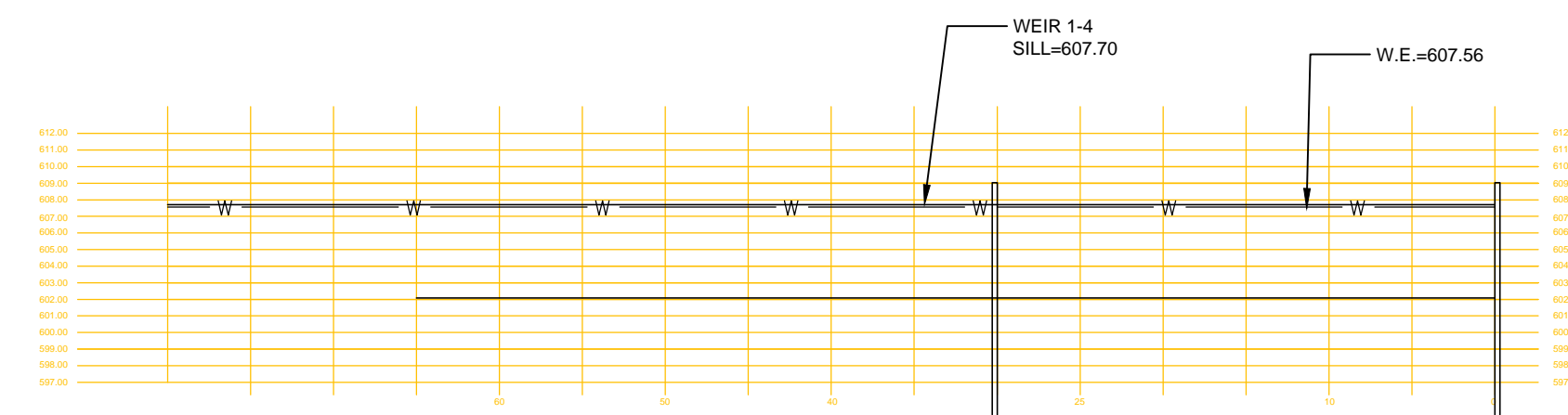
SHEET REFERENCE NUMBER

**G-01**

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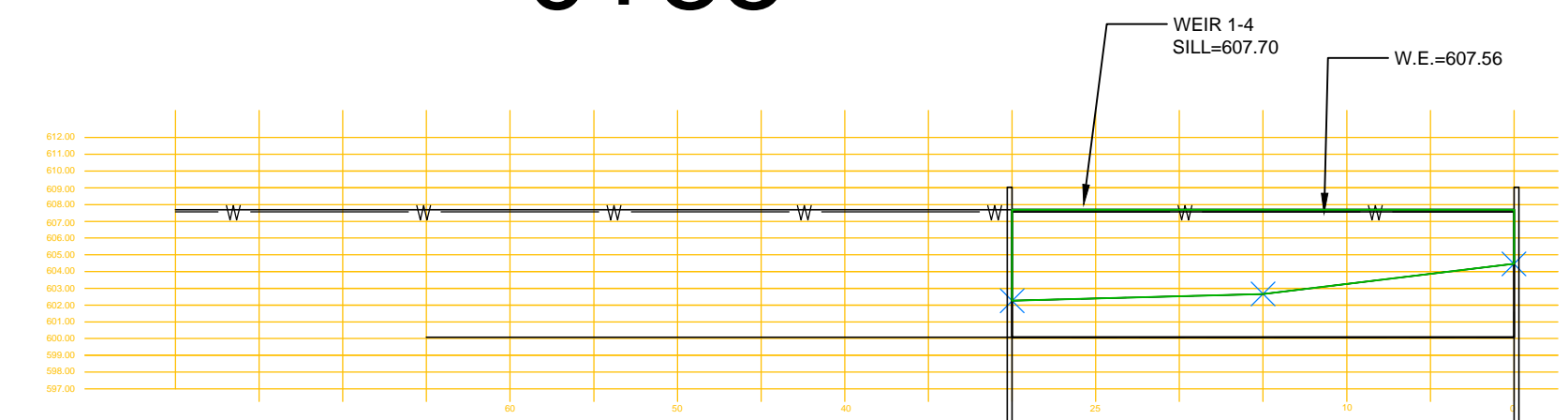
MARQUETTE BOARD OF LIGHT AND POWER  
 CCR COMPLIANCE  
 SHEET PILE MONITORING  
 SHIRAS COAL PLANT

0+00



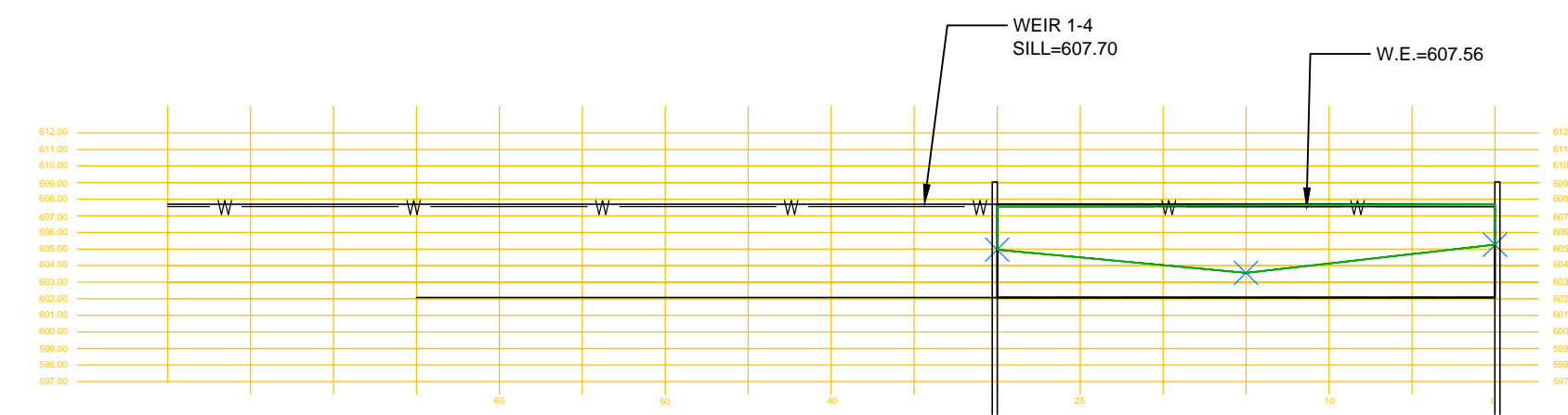
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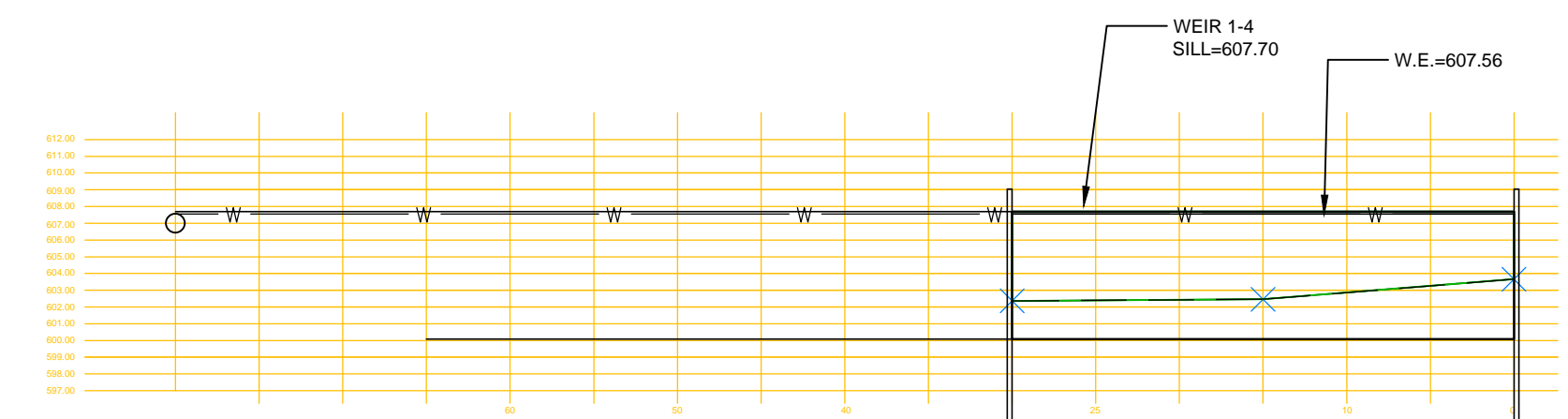
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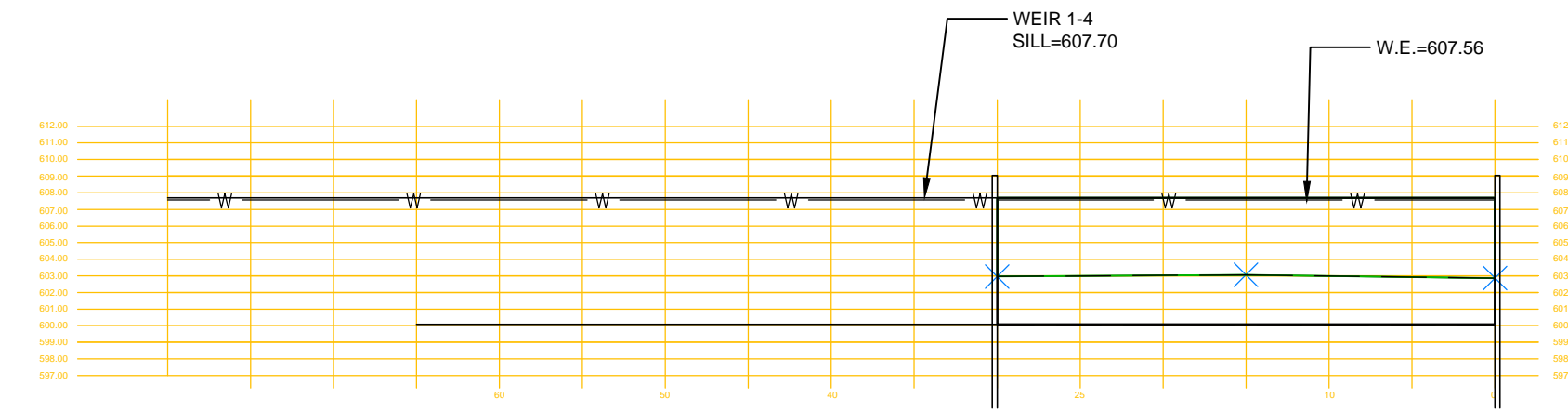
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1+15



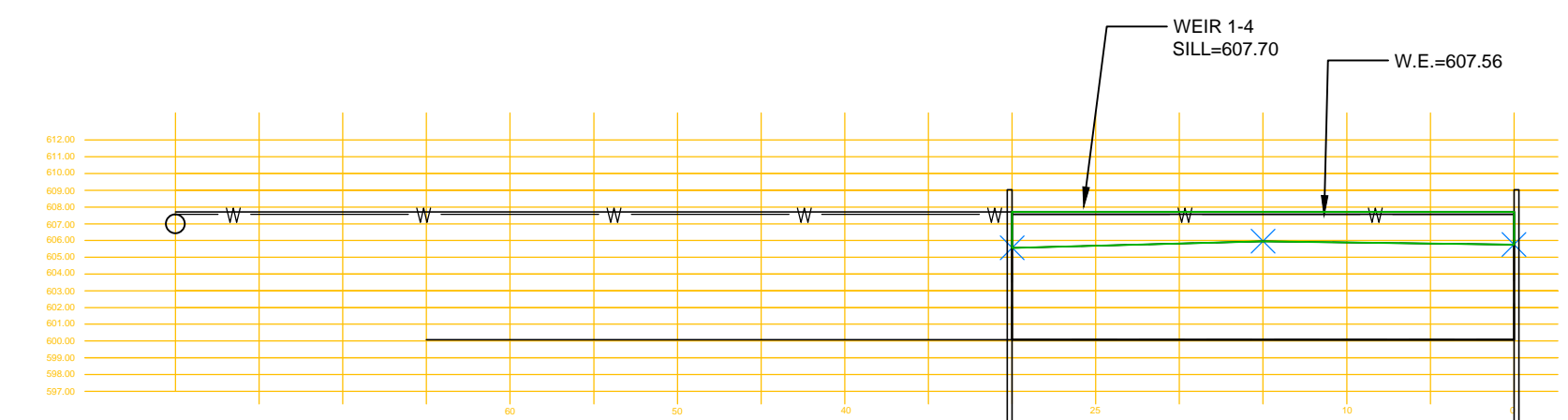
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0+52



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 TOTAL AREA = 228.6 SFT

1+43



MATERIAL AREA = 171.9 SFT  
 MEASURED ADDITIONAL AREA= 56.7 SFT  
 TOTAL AREA = 228.6 SFT

Issued

Rev	Date	Description

R-2	BDP	12/1/2017
2017	ANNUAL	INSPECTION
R-1	BDP	12/15/16
2016	ANNUAL	INSPECTION

Designed:	CLC	10/19/2015
Drawn:	CLC	10/19/2015
Checked:	GHI	XX/XX/2008
Approved:	JKL	XX/XX/2008

PROJECT NUMBER  
**60445171**

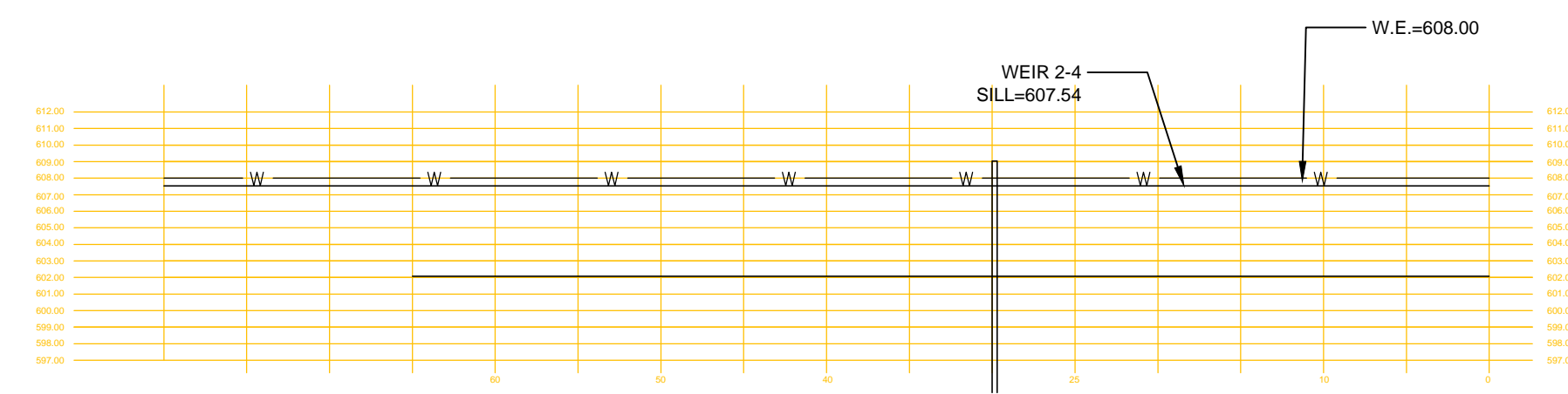
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**G-02**

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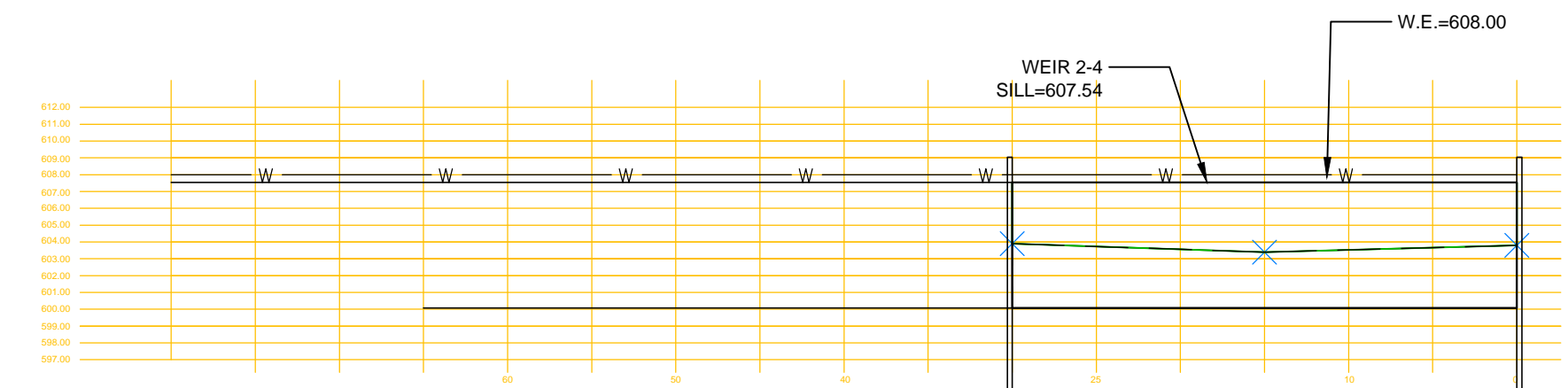
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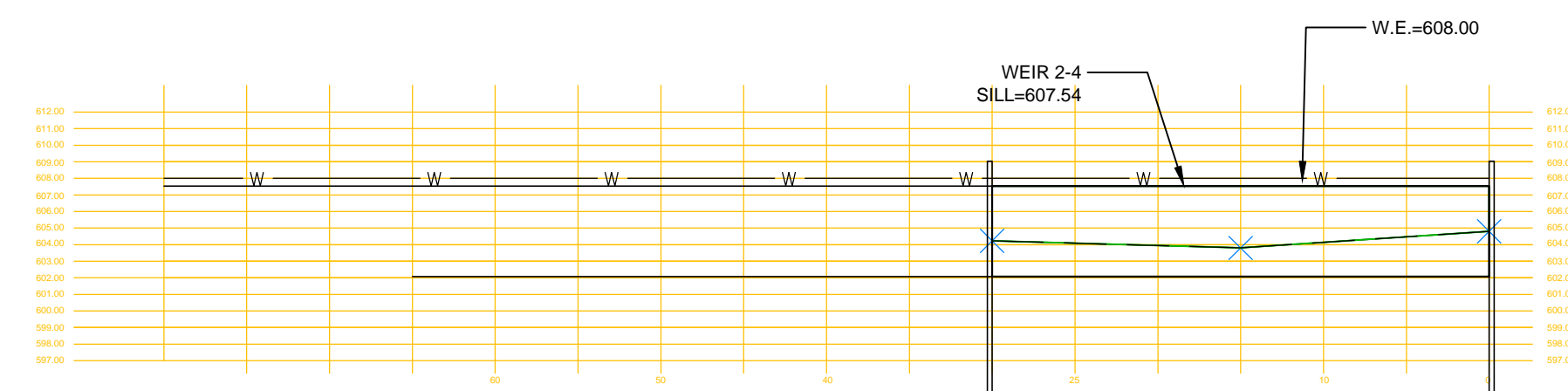
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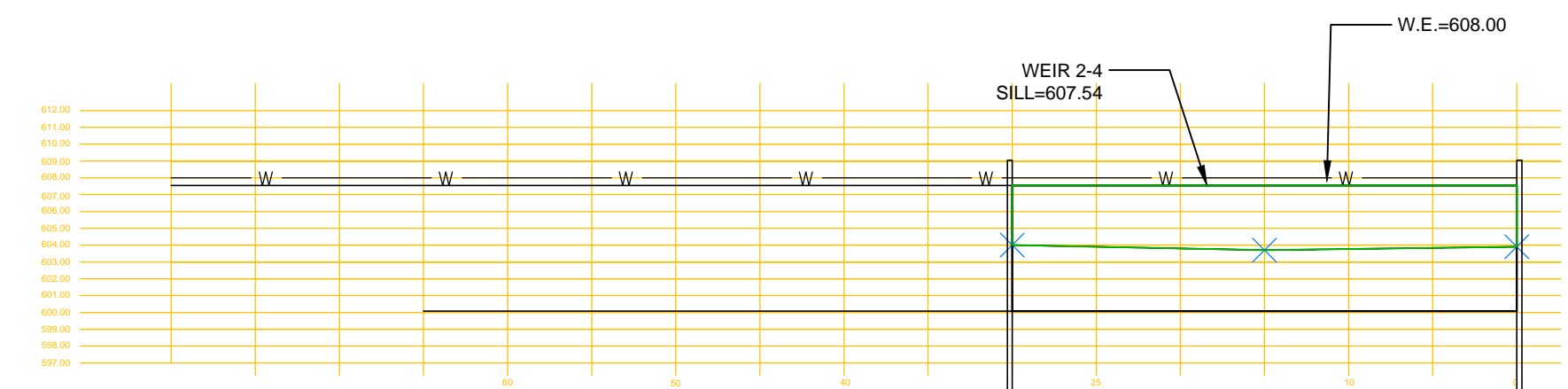
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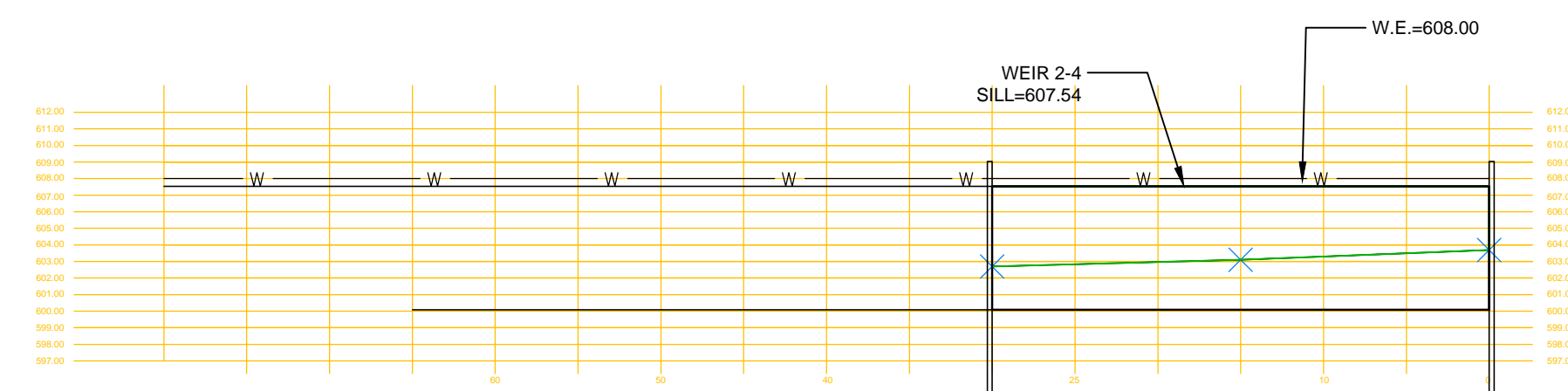
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1+16



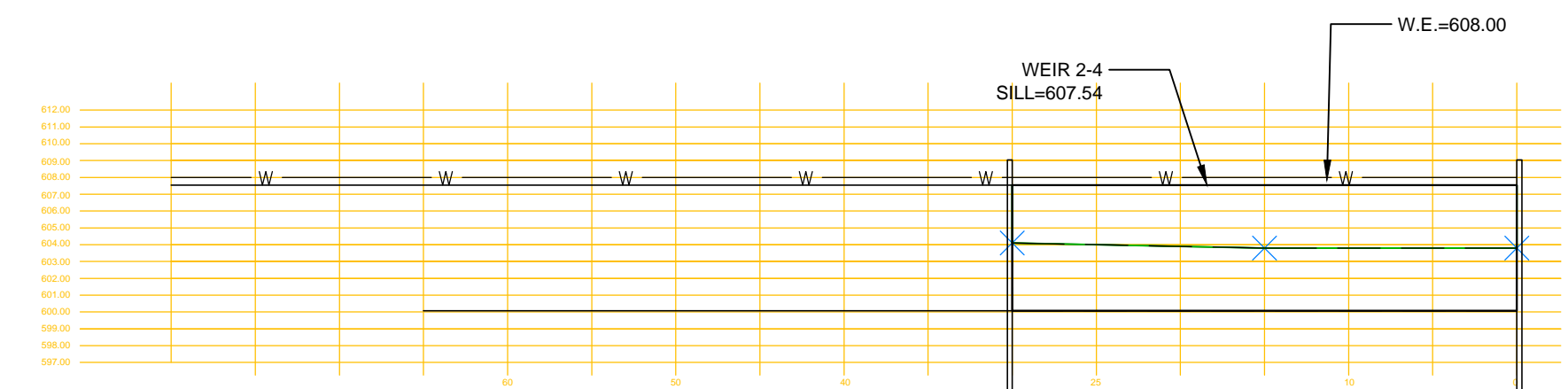
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0+63



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MEASURED ADDITIONAL AREA= 131.7 SFT  
TOTAL AREA = 223.8 SFT

1+45



MATERIAL AREA = 113.9 SFT  
MEASURED ADDITIONAL AREA= 109.9 SFT  
TOTAL AREA = 223.8 SFT

Issued	
Rev	Date

R-2	BDP	12/1/2017
2017 ANNUAL INSPECTION		
R-1	BDP	12/15/2016
2016 ANNUAL INSPECTION		

Designed:	CLC	10/19/2015
Drawn:	CLC	10/19/2015
Checked:	GHI	XX/XX/2008
Approved:	JKL	XX/XX/2008

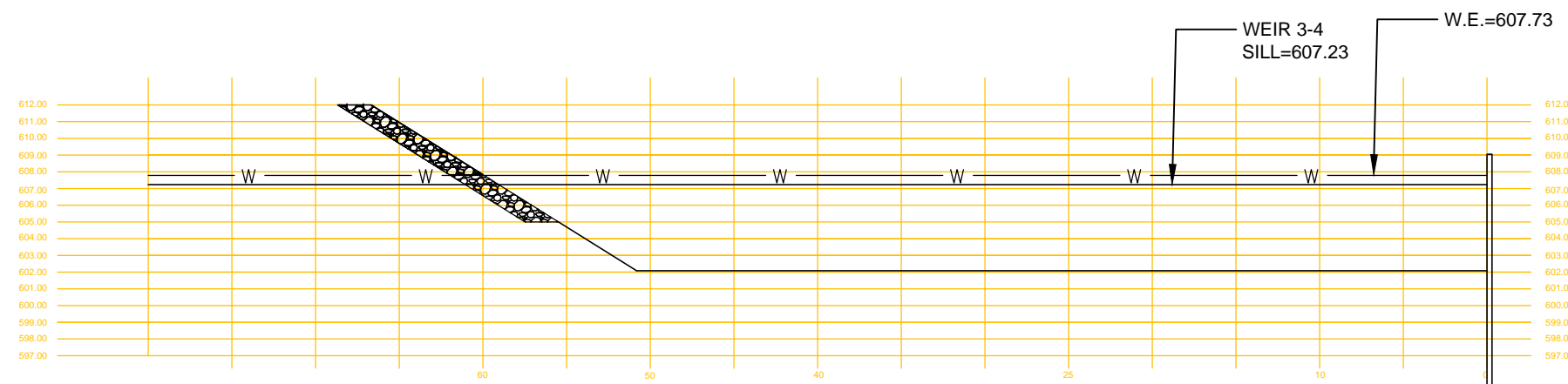
PROJECT NUMBER  
**60445171**

SHEET REFERENCE NUMBER

**G-03**

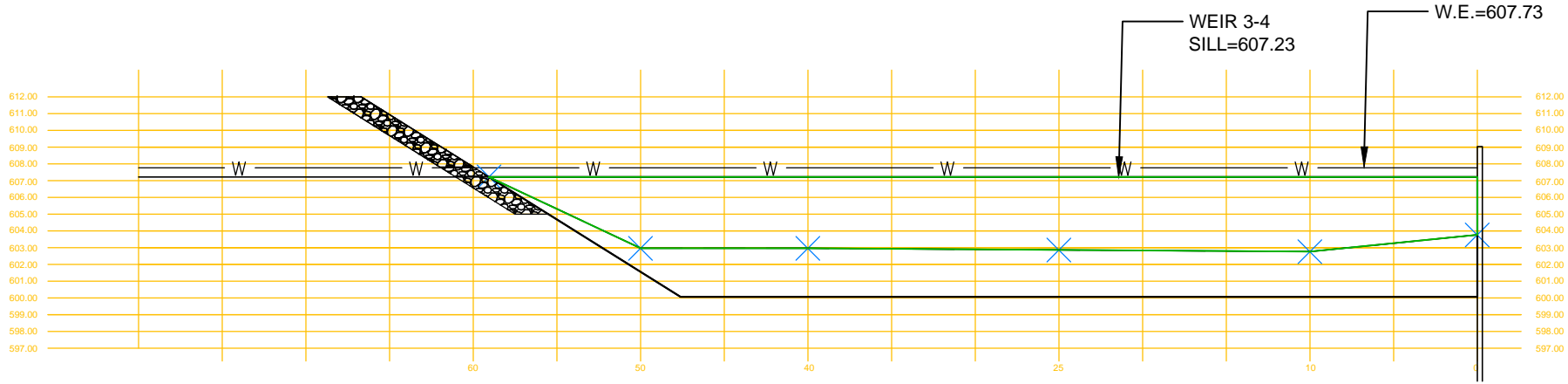
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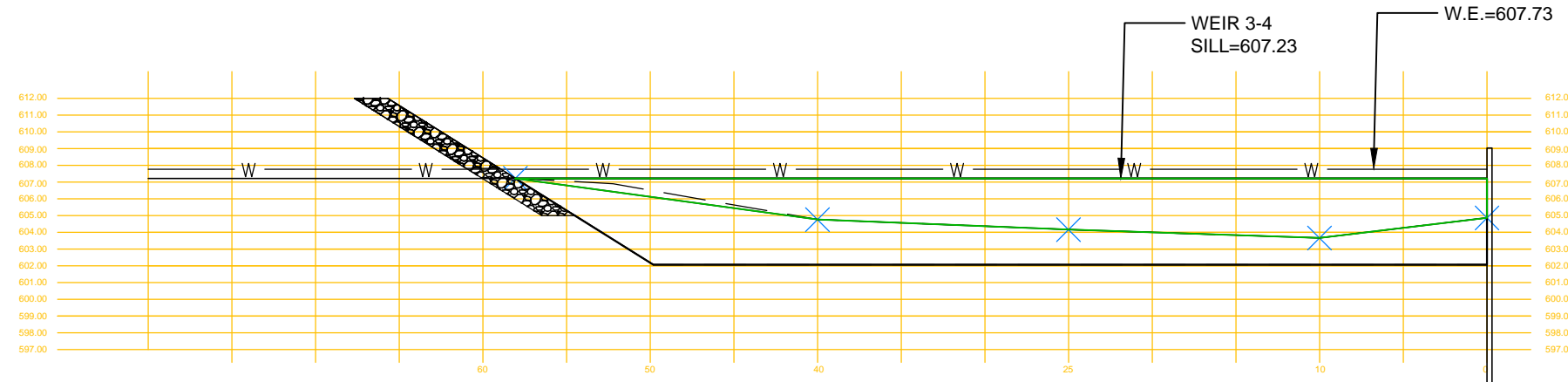
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0+81



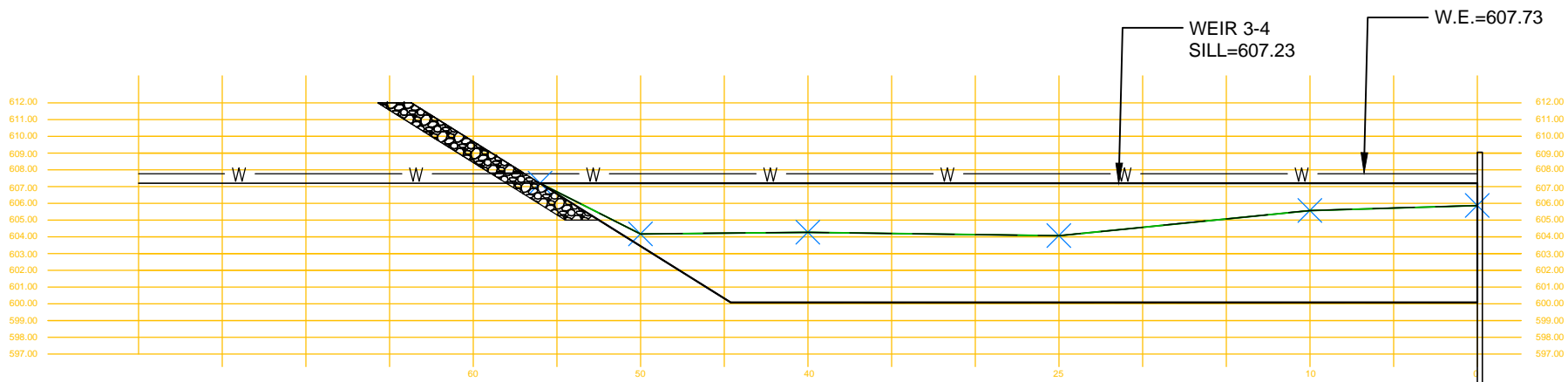
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0+30



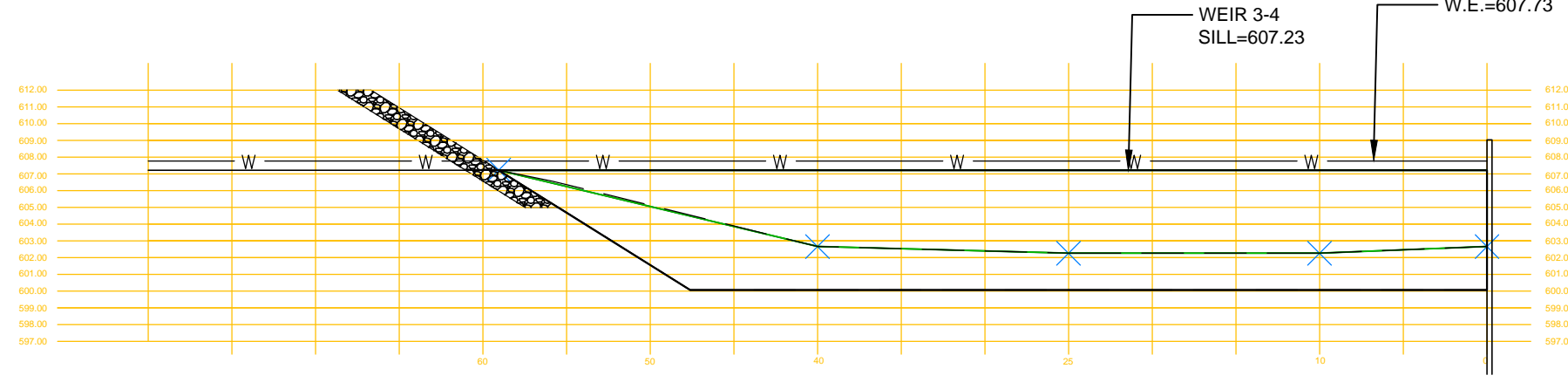
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1+10



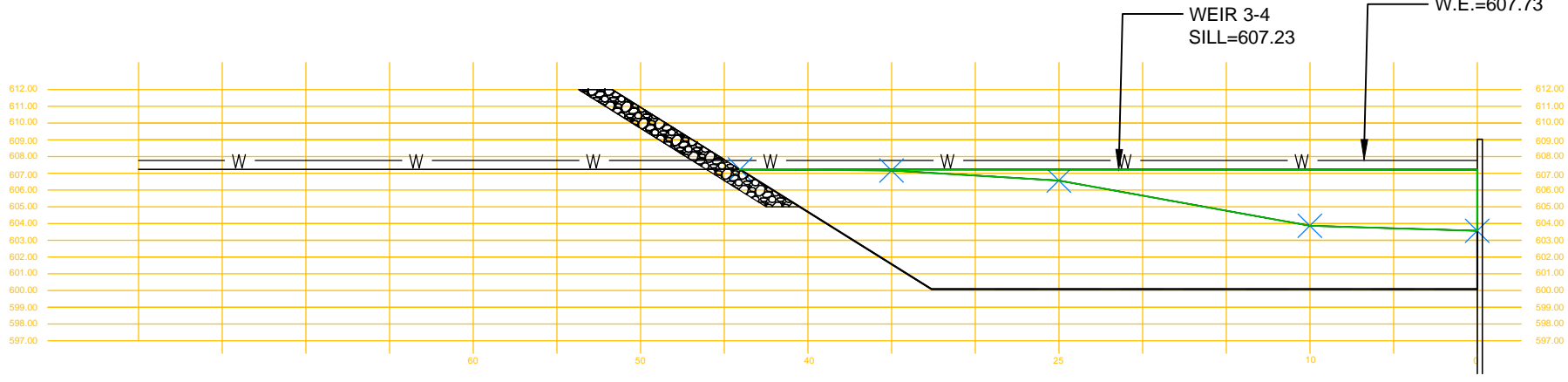
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 TOTAL AREA = 358.2 SFT

0+55



MATERIAL AREA = 145.6 SFT  
 MEASURED ADDITIONAL AREA= 235.8 SFT  
 TOTAL AREA = 381.4 SFT

1+39



MATERIAL AREA = 205.0 SFT  
 MEASURED ADDITIONAL AREA= 69.1 SFT  
 TOTAL AREA = 274.1 SFT

X:\AID\_Settings\_Autodesk\kemp\kemp\10/23/2008 11:59:29 AM AECOM.dwg

Issued	
Rev	Date

R-2	BDP	12/1/2017
R-1	BDP	12/15/2016

Designed:	CLC	10/19/2015
Drawn:	CLC	10/19/2015
Checked:	GHI	XX/XX/2008
Approved:	JKL	XX/XX/2008

PROJECT NUMBER  
**60445171**

SHEET REFERENCE NUMBER

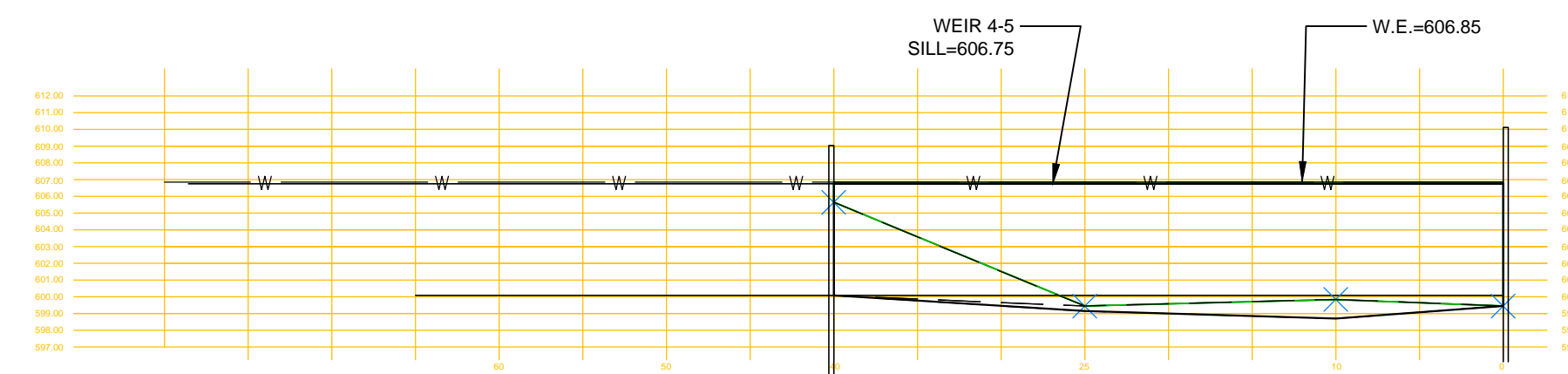
**G-04**

SHEET 04 OF 06

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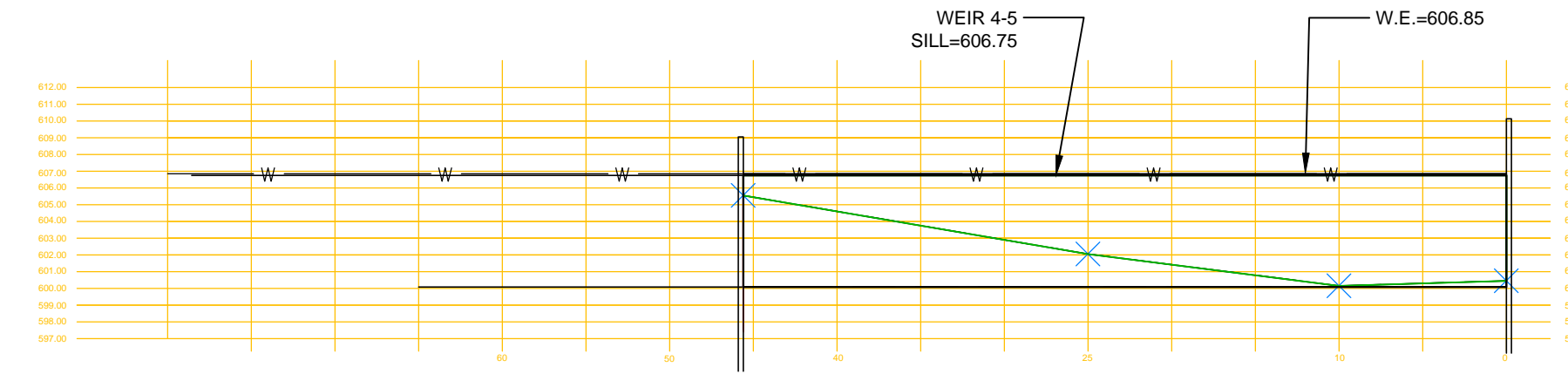
NOTE: CELL 4 BOTTOM HAS BEEN EXCAVATED BELOW 1990 SCA, CINDER POND IMPROVEMENT PROJECT, AT SOME LOCATIONS

0+28



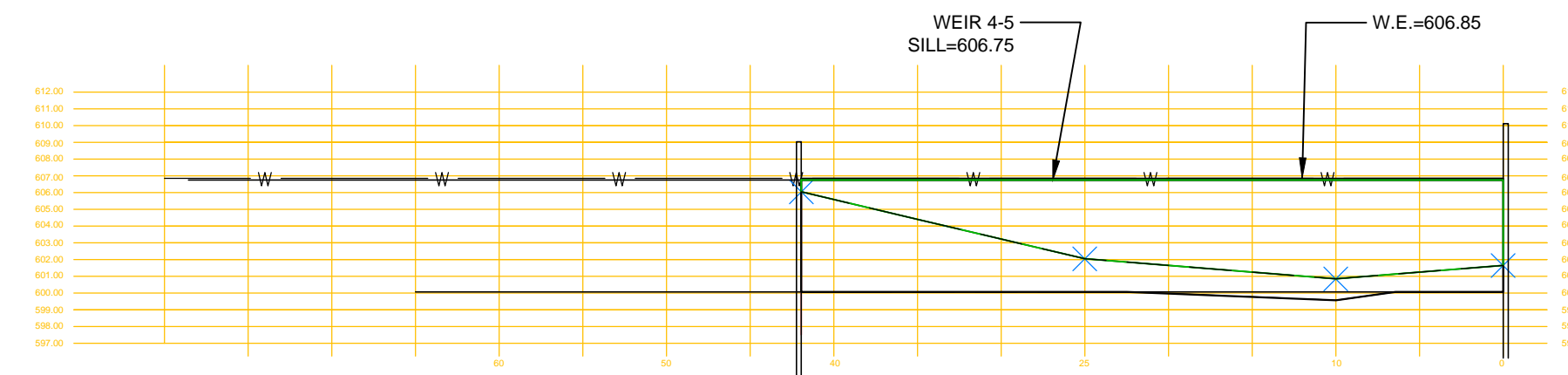
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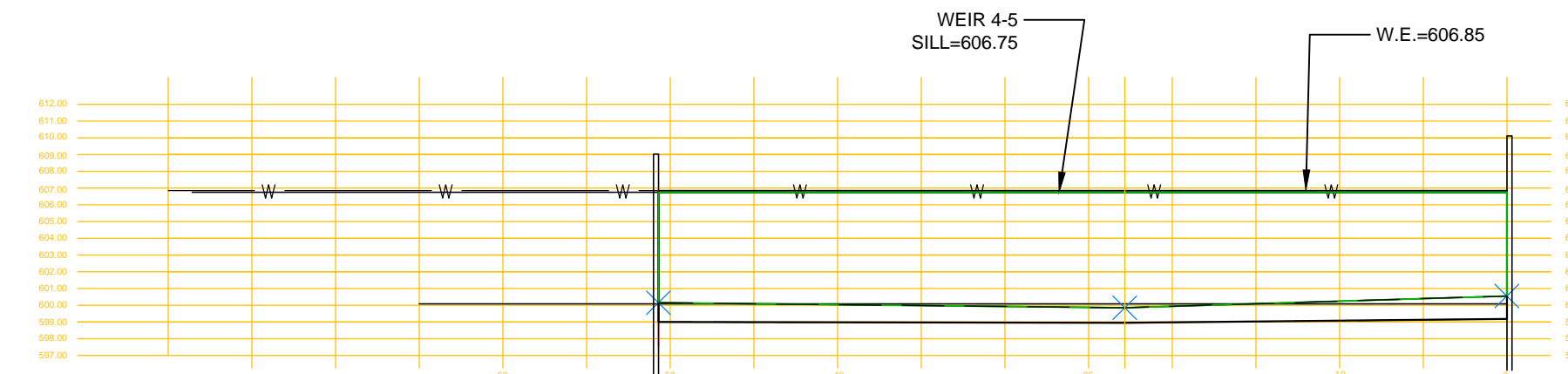
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0+64



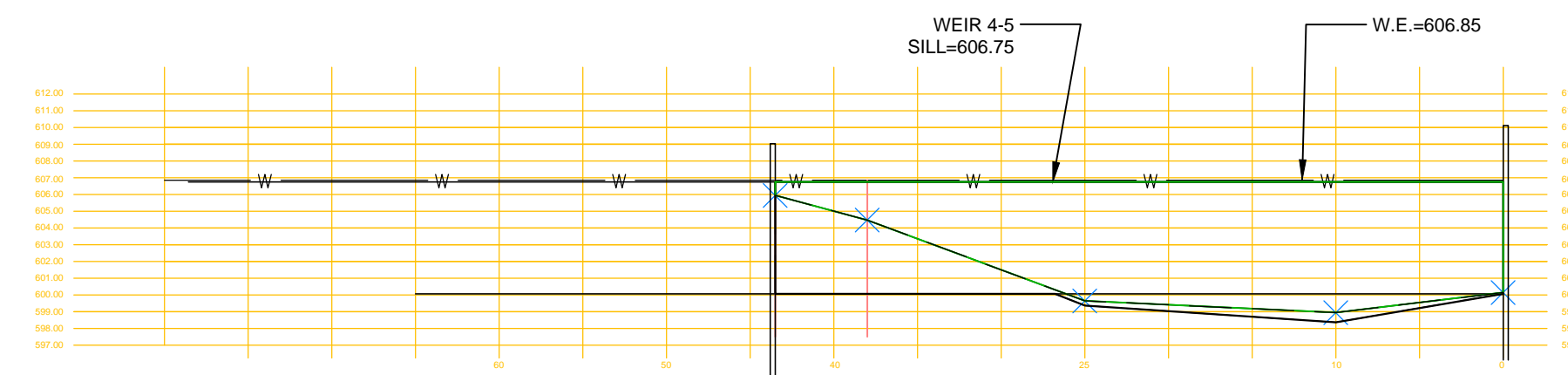
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1+69



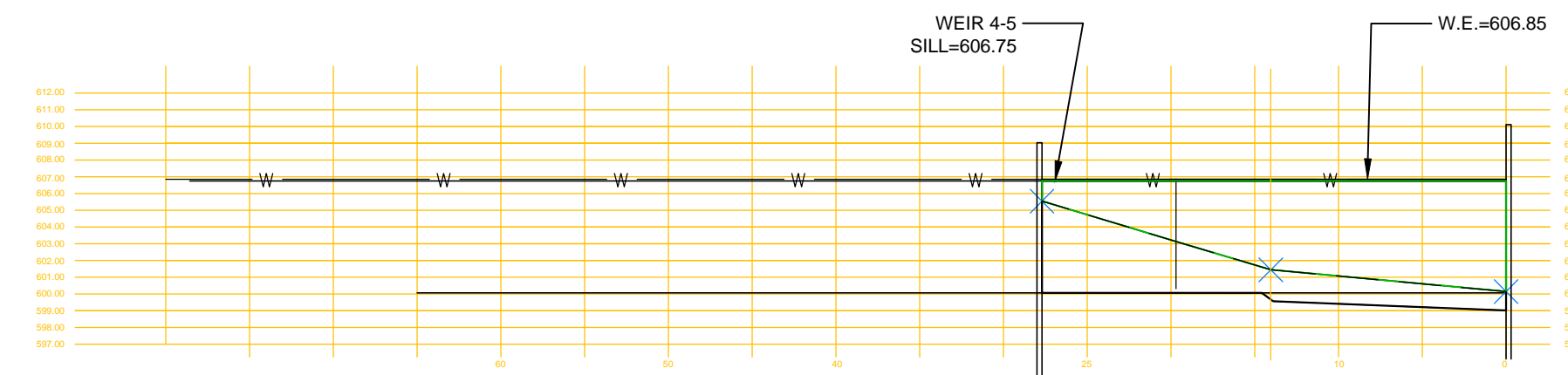
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MEASURED ADDITIONAL AREA= 337.6  
TOTAL AREA = 392.1 SFT

0+93



MATERIAL AREA = 64.2 SFT  
MEASURED ADDITIONAL AREA= 253.1 SFT  
TOTAL AREA = 317.3 SFT

2+19



MATERIAL AREA = 67.8 SFT  
MEASURED ADDITIONAL AREA= 128.0 SFT  
TOTAL AREA = 195.8 SFT

MARQUETTE BOARD OF LIGHT AND POWER  
CCR COMPLIANCE  
SHEET PILE MONITORING  
SHIRAS COAL PLANT

Issued  
Rev Date  
Description

R-2 BDP 12/1/2017  
2017 ANNUAL INSPECTION  
R-1 BDP 12/15/16  
2016 ANNUAL INSPECTION

Designed: CLC 10/19/2015  
Drawn: CLC 10/19/2015  
Checked: GHI XX/XX/2008  
Approved: JKL XX/XX/2008

PROJECT NUMBER  
**60445171**

SHEET REFERENCE NUMBER

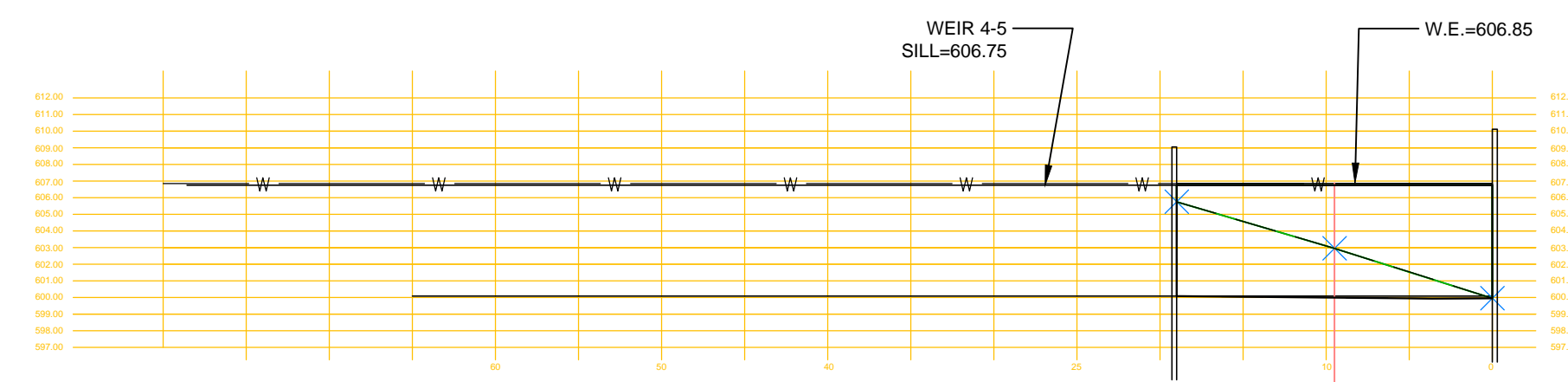
**G-05**

SHEET 05 OF 06

# CELL 4 (Cont.)

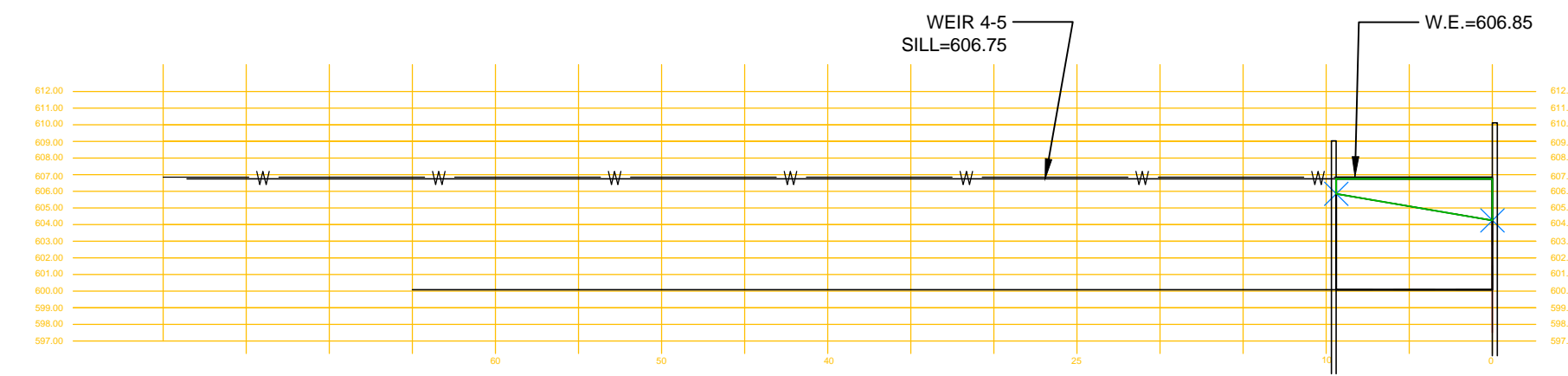
# CELL 5

2+52



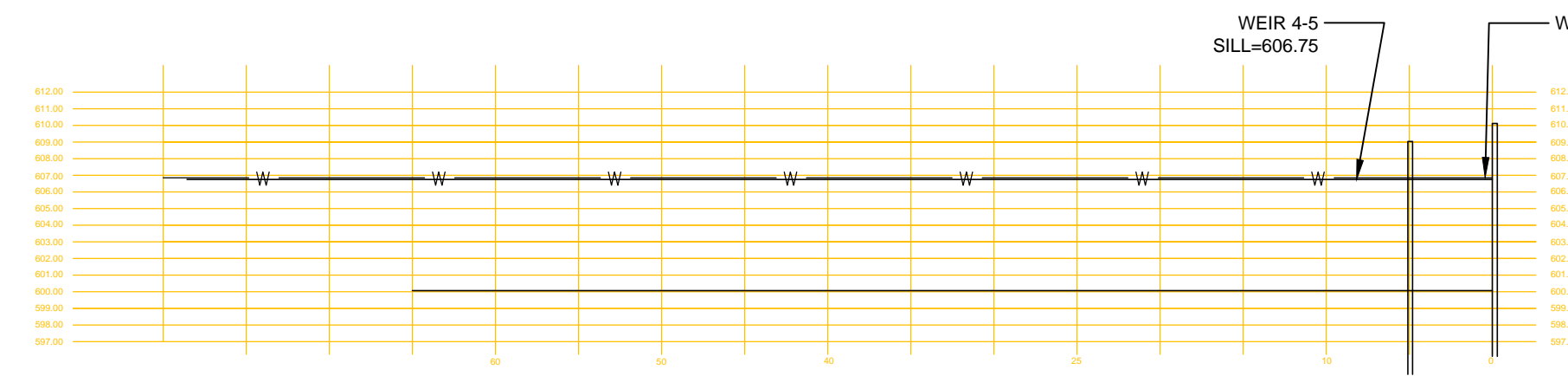
MATERIAL AREA = 55.2 SFT  
MEASURED ADDITIONAL AREA= 74.7 SFT  
TOTAL AREA = 129.9 SFT

2+83



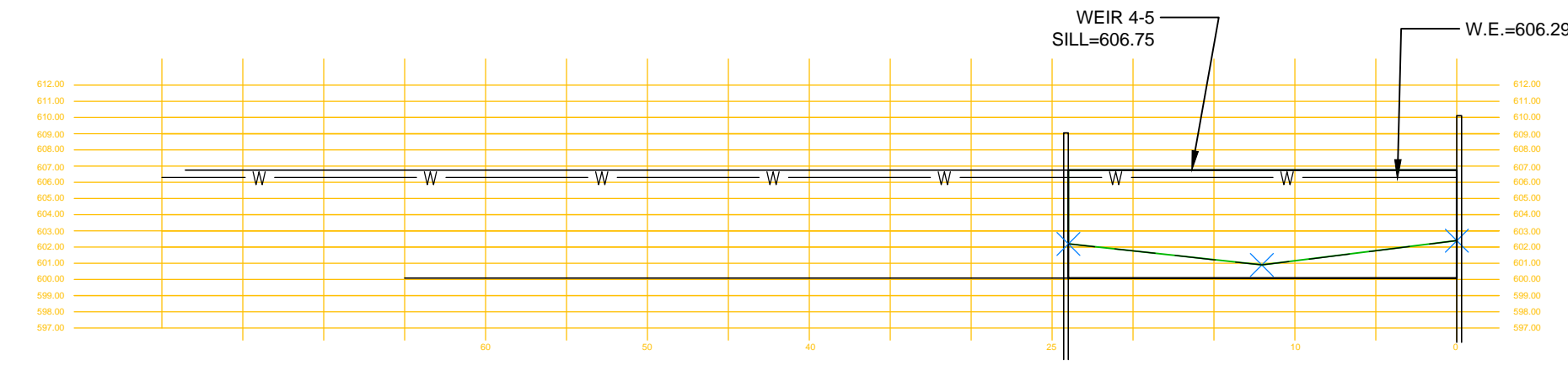
MATERIAL AREA = 46.7 SFT  
MEASURED ADDITIONAL AREA= 16.0 SFT  
TOTAL AREA = 62.7 SFT

2+98



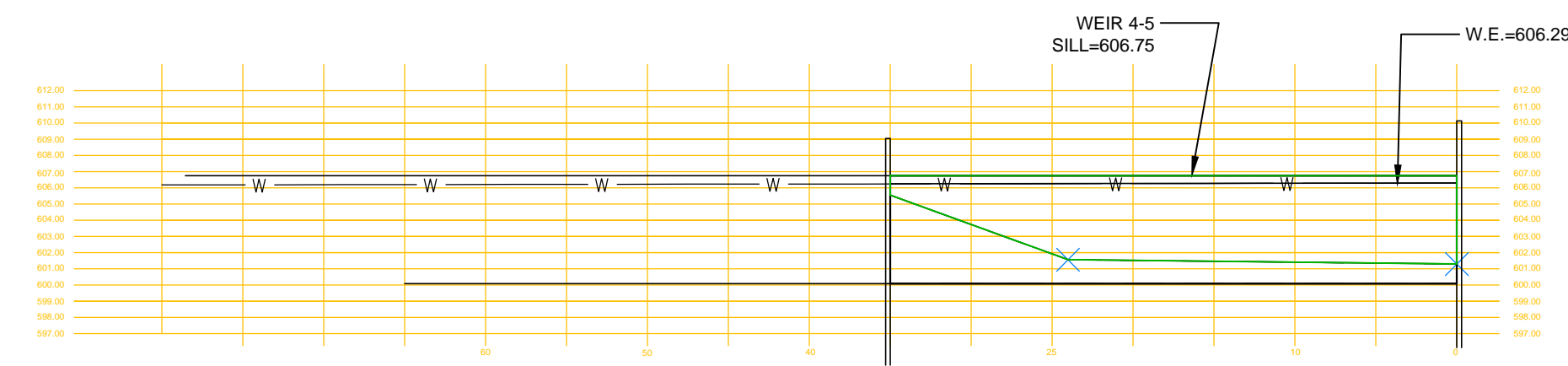
MATERIAL AREA = 0.0 SFT  
MEASURED ADDITIONAL AREA= 0.0 SFT  
TOTAL AREA = 0.0 SFT

0+00



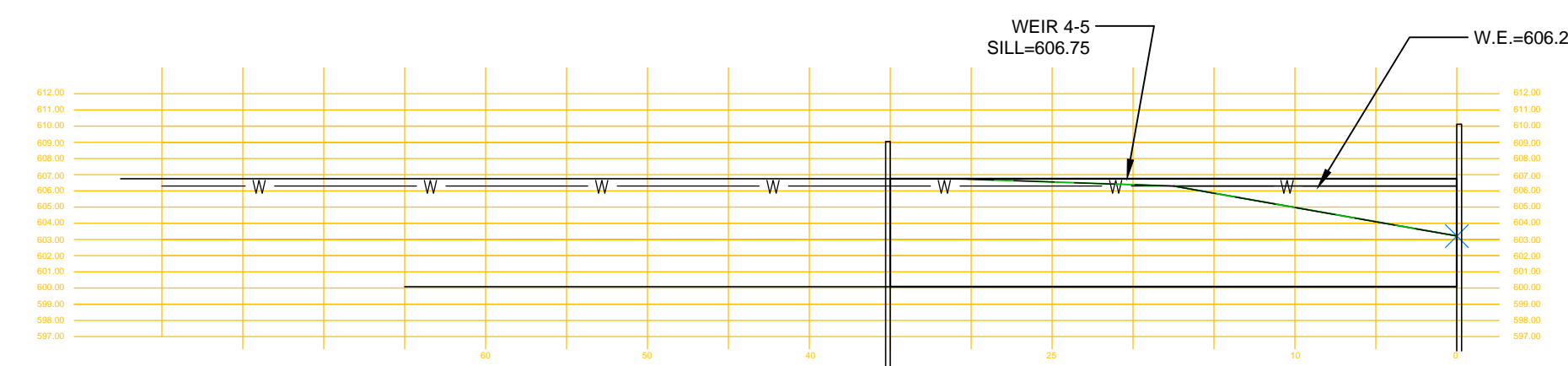
MATERIAL AREA = 36.2 SFT  
MEASURED ADDITIONAL AREA= 123.9 SFT  
TOTAL AREA = 160.1 SFT

0+20



MATERIAL AREA = 70.3 SFT  
MEASURED ADDITIONAL AREA= 163.2 SFT  
TOTAL AREA = 233.5 SFT

0+40



MATERIAL AREA = 195.3 SFT  
MEASURED ADDITIONAL AREA= 38.2 SFT  
TOTAL AREA = 233.5 SFT

MARQUETTE BOARD OF LIGHT AND POWER  
CCR COMPLIANCE  
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SHIRAS COAL PLANT

Issued  
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Description

R-2 BDP 12/1/2017  
2017 ANNUAL INSPECTION  
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Approved: JKL XX/XX/2008

PROJECT NUMBER  
60445171

SHEET REFERENCE NUMBER

G-06

SHEET 06 OF 06

## Appendix B Volume Calculations



**Client:** Marquette Board of Light and Power  
**Project No.:** 60445171  
**Project :** CCR Compliance : Ash Cell Volumes



**Date:** 12/1/2017

<b>CELL 1</b>				
<b>Station</b>	<b>Length (FT)</b>	<b>Occupied Area (SFT)</b>	<b>Unoccupied Area (SFT)</b>	<b>Total Area (SFT)</b>
0+00	0	0.0	0.0	0.0
0+20	20	67.7	100.9	168.6
0+52	32	87.2	141.4	228.6
0+85	22	87.9	140.7	228.6
1+15	30	79.7	148.9	228.6
1+43	28	171.9	56.7	228.6

	<b>CFT</b>	<b>CYD</b>
Occupied Volume =	11117.9	<b>411.8</b>
Unoccupied Volume =	15211.3	<b>563.4</b>
Total Cell 1 Volume =	26329.2	<b>975.2</b>

<b>CELL 2</b>				
<b>Station</b>	<b>Length (FT)</b>	<b>Occupied Area (SFT)</b>	<b>Unoccupied Area (SFT)</b>	<b>Total Area (SFT)</b>
0+08	0	0.0	0.0	0.0
0+40	32	62.3	101.5	163.8
0+63	23	92.1	131.7	223.8
0+87	24	106.4	117.4	223.8
1+16	39	112.4	111.4	223.8
1+45	29	113.9	109.9	223.8

	<b>CFT</b>	<b>CYD</b>
Occupied Volume =	12702.4	<b>470.5</b>
Unoccupied Volume =	14965.5	<b>554.3</b>
Total Cell 2 Volume =	27667.8	<b>1024.7</b>

**CELL 3**

Station	Length (FT)	Occupied Area		Total Area (SFT)
		(SFT)	Unoccupied Area (SFT)	
0+10	0	0.0	0.0	0.0
0+30	20	139.2	138.6	277.8
0+55	25	145.6	235.8	381.4
0+81	26	149.1	232.3	381.4
1+10	29	223.4	134.8	358.2
1+39	29	205.0	69.1	274.1

	<b>CFT</b>	<b>CYD</b>
Occupied Volume =	20396.2	<b>755.4</b>
Unoccupied Volume =	20430.8	<b>756.7</b>
Total Cell 3 Volume =	40827.0	<b>1512.1</b>

**CELL 4**

Station	Length (FT)	Occupied Area		Total Area (SFT)
		(SFT)	Unoccupied Area (SFT)	
0+28	0	60.6	232.7	293.3
0+64	36	103.6	180.2	283.8
0+93	29	64.2	253.1	317.3
1+26	33	94.1	210.1	304.2
1+69	43	54.5	337.6	392.1
2+19	0	67.8	128.0	195.8
2+52	33	55.2	74.7	129.9
2+83	31	46.7	16.0	62.7
2+98	15	0.0	0.0	0.0

	<b>CFT</b>	<b>CYD</b>
Occupied Volume =	15154.8	<b>561.3</b>
Unoccupied Volume =	38003.8	<b>1407.5</b>
Total Cell 4 Volume =	53158.6	<b>1968.8</b>

### CELL 5

Station	Length (FT)	Occupied Area (SFT)	Unoccupied Area (SFT)	Total Area (SFT)
0+00	0	36.2	123.9	160.1
0+20	20	70.3	163.2	233.5
0+40	20	195.3	38.2	233.5

	CFT	CYD
Occupied Volume =	3721.0	<b>137.8</b>
Unoccupied Volume =	4885.0	<b>180.9</b>
Total Cell 5 Volume =	8606.0	<b>318.7</b>

### Total System

	CFT	CYD
Occupied Volume =	63092.2	<b>2336.7</b>
Unoccupied Volume =	93496.4	<b>3462.8</b>
Total Volume =	156588.5	<b>5799.6</b>

## Appendix C Photo Log

Marquette Board of Light and Power, Shiras Steam Plant, Holding Pond



Photo1- Holding Pond



Photo 2 – Overall View of East Wall

Marquette Board of Light and Power, Shiras Steam Plant, Holding Pond



Photo 3 – Recently Constructed North Sheet Pile Wall



Photo 4 – Corrosion at Joints

Marquette Board of Light and Power, Shiras Steam Plant, Holding Pond



Photo 5 – Spot with Localized Corrosion



Photo 6 – Interior Walls in Poor Condition

