碧水庄园
GREEN RIVERS MANOR

Hydrotech

Project Case Study
Green Rivers Manor
Beijing, PR China

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December 2009

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1.0 Introduction

Hydrotech Asia Limited and Hydrotech China Company Limited herein referred to as “Hydrotech”, were appointed by the Owner of the Green Rivers Manor location at Block 39 Lot 17 to provide water ingress solution to existing water dampness at the basement of the property.

The Owner of the property is concerned about dampness that may affect his wine storage and entertainment area which are all situated at one level basement of approximately 550 square meters floor & wall areas. The height of basement walls is approximately 3.5metres.

Hydrotech was allotted 10 calendar days to mobilise and install the MPS System commencing from 27 May to 5 June 2009.

2.0 Project Location

Green Rivers Manor was developed by the Beijing Blue Water Manor Property Development Limited Company. The luxury subdivision is situated at the national capital northern suburbs along the Badaling Expressway Exit 11, refer to the figure 1 below.

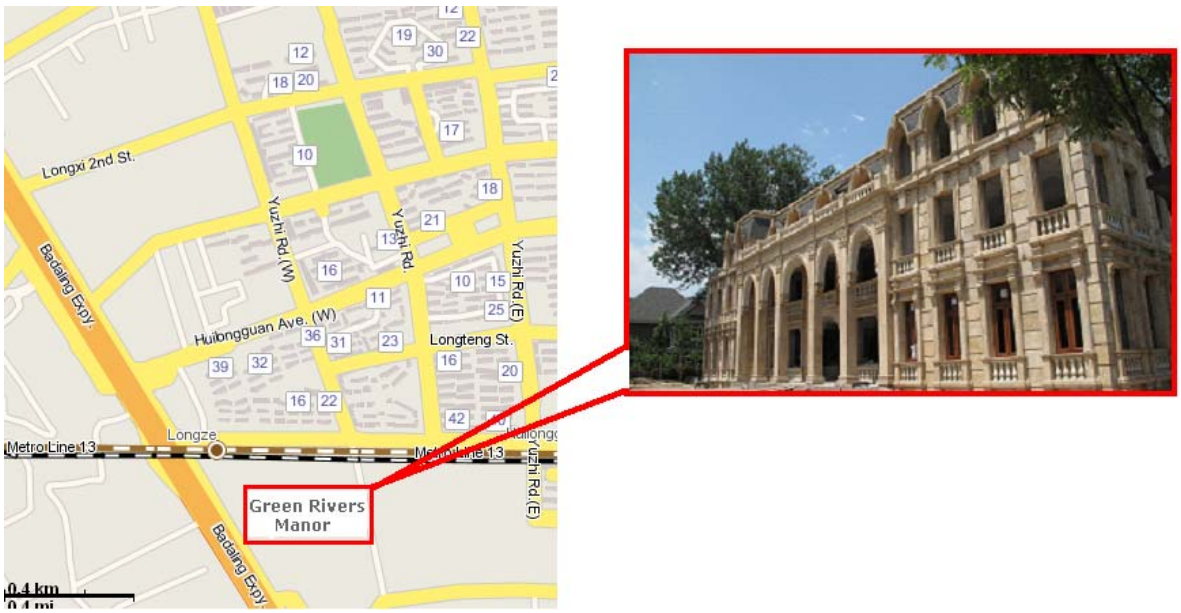

Figure 1

3.0 General Description of Green Rivers Villa

The luxurious Green Rivers Villa property is located inside the Green Rivers Manor Residential Subdivision situated at Block 39 Lot 17. It is a single detached 4-storey residential mansion equip with indoor swimming pool and filtration system, private lift, heating & ventilation system and a spacious basement for entertainment, recreation and wine storage facilities. The structure is a conventional reinforced concrete construction with spread foundation and tie beams. The floor slab of the basement has a built-in floor heating system. Due to this existing heating pipes buried on the floors; many site challenges and difficulties has emerged during the installation of the MPS System, refer to Figure 2.

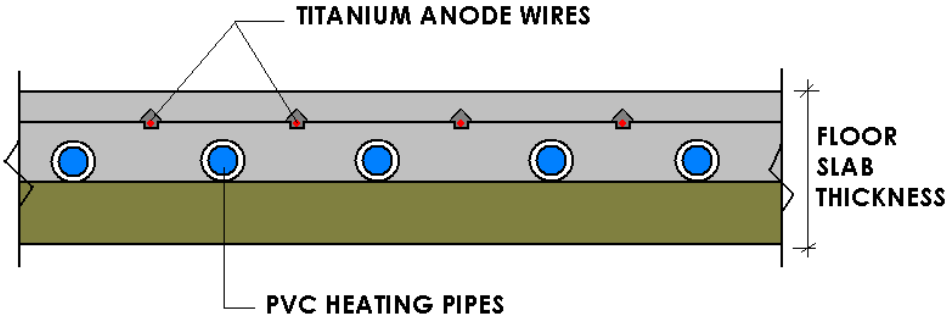

Figure 2

A typical MPS System layout diagram indicating the location of each major component is shown in Figure 3.

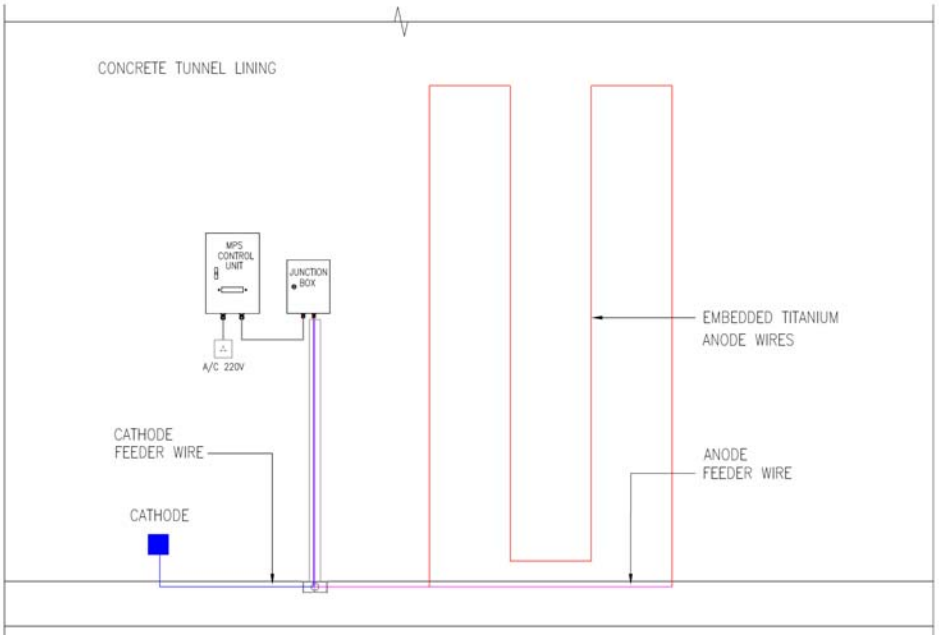

Figure 3

4.0 Problem Statement

The Green Rivers Villa was just completed in 2008 and suffers from water ingress and raising damp on external walls, internal partition walls, floors slab and interior columns within the basements, refer to photos below.

Initial Conditions of Exterior Walls

Initial Conditions of Interior Walls

Various measures have been adopted to control the water ingress such as patch repairs and cementitious water proofing coating system was previously adopted to control the dampness but it failed to provide a long-term solution.

Initial Conditions at the corners of Exterior & Interior Walls

Raising Damp on Interior Brick Wall Partition

Areas that has been previously repaired but the water seepage was still visible

The long-term effects of water dampness in basements may pose danger to the health of the occupants such as build-up of mould and algae growth which may lead to respiratory diseases.

Failure to address water ingress problems may also lead to early corrosion of existing reinforcements embedded inside the basement walls and floor slab causing structure degradation and shorter life-span of the structure.

5.0 Hydrotech's Scope of Works

The scopes of works by Hydrotech for Green Rivers Villa are as follows:

- Provide a comprehensive MPS System design to cater for the existing basement condition considering heating pipes was already installed.

- Supply all materials for the MPS System including control units, junction box, titanium wire, cathodes, feeder wires and connectors necessary to complete the installation.

- Provide all the necessary tools for the installation.
- Provide technical training to all the workers with regards to the extent of works to be carried out on site.
- Supervise the installation of the MPS System.
- Test, commission and provide final results report on the performance of the MPS System.

6.0 MPS System Design for Green Rivers Villa

The MPS System design for Green Rivers Villa Block 39 Lot 17 is shown in Figure 4.

Total length of titanium anode wires: 800m
Anode spacing: 800 to 1200mm c/c
Total number of cathodes: 2
Total length of feeder wires: 1300m
Total length of trunking system: 60m

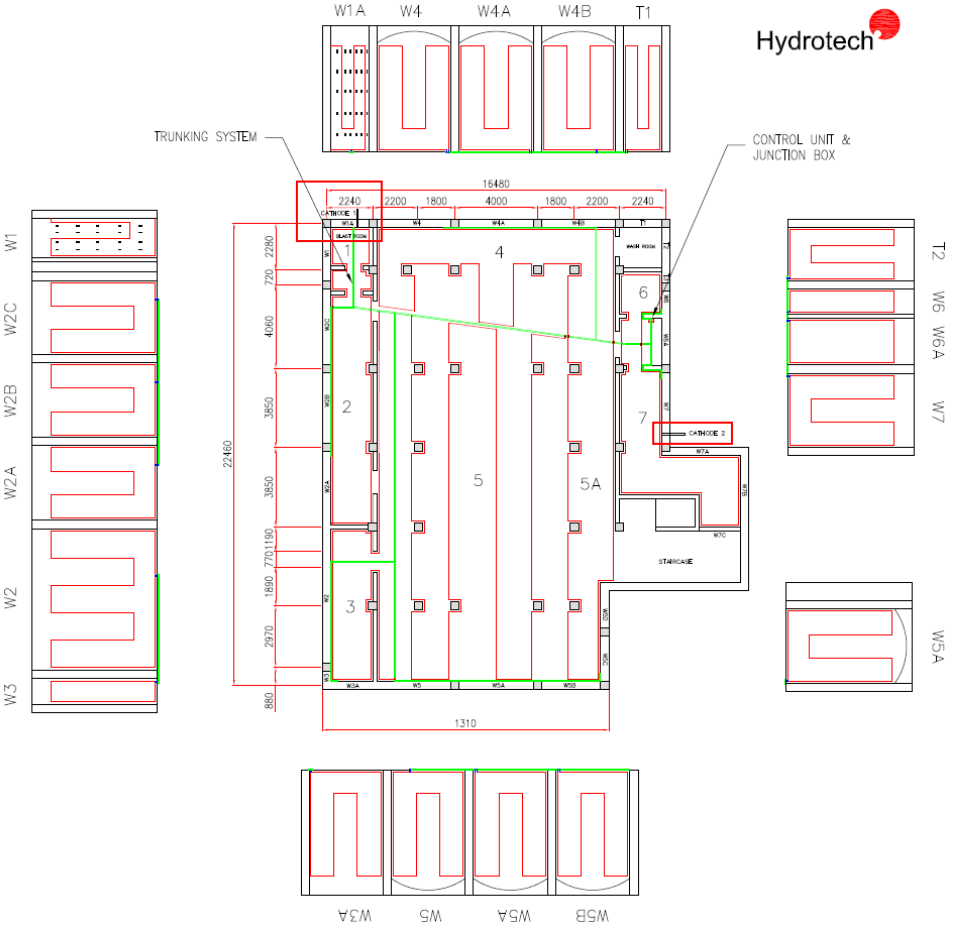

Figure 4

7.0 MPS System Green Rivers Villa Site Installation


Survey of Existing Heating Pipes on Floors


Setting out & Marking of Titanium Anode Wires on Floors


Setting out & Marking of Titanium Anode Wires on Walls

Saw Cutting on Floor Slabs

Saw Cutting on Exterior Walls


Inserting of Titanium Anode Wires on Wall and Preparation of PVC spacer


Cleaning of Grooves & Installation of Titanium Anode Wires

Grouting of Grooves

Completed Grouting Works on Wall and Floor




Feeder Wire & Trunking System Installation


Completed Cathode Installation

Final Connection to Junction Box and Control Unit

Completed Green River Villa Installation

8.0 Performance Monitoring

8.1 Electrical Current Readings from 16 July to 19 September 2009

Performance Monitoring at Green Rivers Manor, Beijing PR China
Note: Installation was completed on June 5, 2009. Activation of MPS System was on 16 July 09

Hydrotech

	Date of site visit:	16-Jul-09	31-Jul-09	15-Aug-09	1-Sep-09	2-Sep-09	3-Sep-09	4-Sep-09	5-Sep-09	6-Sep-09	7-Sep-09	8-Sep-09	11-Sep-09	12-Sep-09	16-Sep-09	19-Sep-09
	Weather:	Sunny	Raining	Sunny	Sunny	Cloudy	Cloudy	Raining	Raining	Raining	Raining	Sunny	Sunny	Sunny	Sunny	Raining
	Temperature:	30℃	32℃	32℃	30℃	28℃	28℃	26℃	25℃	19℃	21℃	27℃	26℃	27℃	29℃	21℃
	LCD Reading:	24%	31%	31%	31%	30%	29%	30%	29%	28%	30%	30%	29%	28%	29%	28%
No.	Anode - WALLS	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
1	ALL	1.90	2.41	2.35	2.23	2.12	2.29	2.25	2.25	2.15	2.16	2.21	3.20	2.45	2.21	2.92
2	ALL 1-7 (Floor)	0.90	2.15	2.14	2.15	1.92	2.12	2.15	2.06	1.97	2.04	2.13	1.19	2.74	2.74	2.72
3	All Wall	0.82	2.21	2.24	1.90	1.95	1.73	1.93	1.84	1.92	1.93	2.11	1.00	2.48	2.52	2.53
4	W1	0.84	0.97	0.76	0.58	0.47	0.54	0.56	0.57	0.54	0.54	0.52	0.80	0.72	0.70	0.66
5	W1A															
6	W2	0.78	0.62	0.68	0.49	0.49	0.46	0.51	0.51	0.49	0.44	0.42	0.60	0.50	0.51	0.52
7	W2A	1.12	0.75	0.75	0.68	0.59	0.65	0.68	0.67	0.65	0.65	0.62	1.04	0.98	0.96	0.91
8	W2B	1.12	0.76	0.70	0.65	0.47	0.62	0.66	0.62	0.62	0.63	0.76	0.97	0.90	0.91	0.91
9	W2C	1.19	0.60	0.77	0.71	0.57	0.65	0.65	0.65	0.66	0.72	0.68	1.06	0.97	1.02	0.97
10	西南角 W3	0.52	0.43	0.46	0.35	0.33	0.33	0.32	0.33	0.33	0.31	0.29	0.43	0.35	0.35	0.36
11	西南角 W3A	0.52	0.60	0.42	0.30	0.27	0.31	0.31	0.33	0.32	0.30	0.29	0.41	0.34	0.34	0.33
12	W4	0.83	0.61	0.54	0.42	0.41	0.39	0.39	0.41	0.36	0.38	0.36	0.53	0.49	0.47	0.46
13	W4A	0.70	0.73	0.47	0.40	0.36	0.37	0.39	0.38	0.36	0.39	0.36	0.49	0.46	0.47	0.43
14	W4B	0.74	0.56	0.52	0.41	0.36	0.39	0.40	0.39	0.38	0.39	0.49	0.53	0.48	0.48	0.46
15	厅南墙 W5	0.70	0.54	0.52	0.45	0.40	0.41	0.44	0.44	0.42	0.42	0.40	0.58	0.54	0.54	0.52
16	厅南墙 W5A	0.68	0.75	0.50	0.42	0.39	0.40	0.40	0.39	0.38	0.39	0.39	0.32	0.49	0.45	0.45
17	厅南墙 W5B	0.68	0.35	0.54	0.47	0.37	0.45	0.46	0.46	0.45	0.48	0.42	0.43	0.52	0.47	0.42
18	W5C	0.43	0.28	0.32	0.25	0.23	0.24	0.25	0.24	0.25	0.24	0.32	0.25	0.30	0.29	0.27
19	W5D	0.33	0.50	0.23	0.18	0.11	0.17	0.18	0.17	0.22	0.17	0.11	0.23	0.20	0.21	0.19
20	W6	0.69	0.48	0.37	0.46	0.45	0.28	0.31	0.31	0.30	0.30	0.31	0.45	0.43	0.40	0.40
21	W6A	0.59	0.33	0.33	0.30	0.33	0.27	0.29	0.29	0.28	0.27	0.27	0.41	0.33	0.37	0.35
22	W7	1.05	1.13	0.59	0.49	0.39	0.48	0.49	0.49	0.47	0.47	0.48	0.69	0.62	0.62	0.57
23	东南角 W7A	0.86	0.92	0.73	0.45	0.44	0.45	0.45	0.46	0.40	0.45	0.44	0.64	0.59	0.60	0.59
24	W7B	0.76	0.48	0.45	0.43	0.29	0.37	0.39	0.37	0.39	0.43	0.35	0.59	0.51	0.51	0.52
25	W7C	0.34	0.22	0.21	0.18	0.08	0.17	0.17	0.18	0.17	0.16	0.16	0.24	0.22	0.21	0.20
26	T1	1.20	0.00	0.00												
27	T2	1.14	0.86	1.32	1.15	1.17	1.12	1.16	1.15	1.12	1.12	1.05	1.40	1.36	1.46	1.41
28	T3	0.53	0.54	0.35	0.31	0.32	0.29	0.30	0.33	0.25	0.29	0.27	0.44	0.41	0.39	0.39
	Anode - FLOORS	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
29	ALL 1-7 (Floor)															
30	1	1.45	1.52	1.52	1.42	1.54	1.35	1.38	1.38	1.34	1.38	1.41	2.09	1.96	1.97	1.92
31	2															
32	3	1.50	1.42	1.36	1.37	1.17	1.29	1.33	1.29	1.27	1.34	1.29	1.80	1.76	1.56	1.77
33	4	1.59	1.57	1.56	1.47	0.94	1.46	1.43	1.45	1.41	1.47	1.48	2.10	1.96	1.48	2.00
34	5	1.61	1.67	1.67	1.66	1.57	1.55	1.57	1.58	1.53	1.56	1.62	2.30	2.14	2.15	2.04
35	5A	1.58	1.53	1.51	1.45	1.08	1.39	1.37	1.39	1.35	1.45	1.39	2.00	1.98	1.96	1.89
36	6	0.75	0.71	0.72	0.76	0.56	0.69	0.78	0.71	0.67	0.70	0.67	1.12	1.07	1.11	1.08
37	7	1.13	1.15	1.15	1.15	1.12	1.07	1.27	1.11	1.02	1.18	1.22	1.20	1.94	1.53	1.54
	Cathode															
38	ALL C						2.25	2.66	2.38	2.23	2.29	2.26	3.19	2.96	2.64	2.90
39	C1	1.37	1.69	1.82	1.79	1.49	1.65	1.66	1.65	1.71	1.65	1.67	2.30	2.13	2.17	2.16
40	C2	0.62	0.92	0.78	0.82	0.63	0.79	0.90	0.85	0.77	0.80	0.80	1.10	1.03	1.01	1.01

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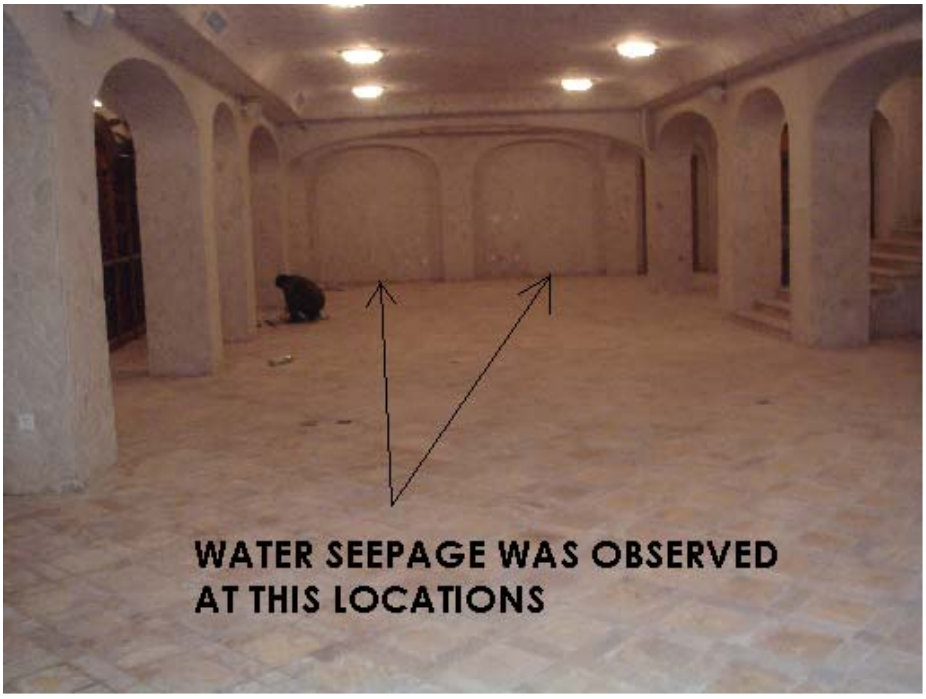
8.2 Electrical Current Readings from 20 September to 22 December 2009

Performance Monitoring at Green Rivers Manor, Beijing PR China

Note: Installation was completed on June 5, 2009. Activation of MPS System was on 16 July 09

	Date of site visit:	20-Sep-09	21-Sep-09	24-Sep-09	26-Sep-09	9-Oct-09	11-Oct-09	15-Oct-09	19-Oct-09	23-Oct-09	31-Oct-09	4-Nov-09	13-Nov-09	19-Nov-09	21-Nov-09	8-Dec-09	22-Dec-09
	Weather:	Sunny	Sunny	Sunny	Raining	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny
	Temperature:	21℃	21℃	27℃	24℃	20℃	20℃	23℃	16℃	23℃	12℃	17℃	4℃	16℃	5℃	7℃	4℃
	LCD Reading:	28%	28%	28%	27%	28%	28%	28%	26%	26%	26%	25%	25%	26%	25%	24%	23%
No.	**Anode - WALLS**	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
1	**ALL**	2.92	2.90	2.93	2.82	2.97	2.96	2.95	2.84	2.81	2.82	2.69	2.72	2.84	2.73	2.68	2.50
2	**ALL 1-7 (Floor)**	2.69	2.67	2.68	2.66	2.77	2.73	2.72	2.56	2.62	2.62	2.46	2.52	2.56	2.47	2.36	2.31
3	**All Wall**	2.48	2.49	2.45	2.39	2.45	2.43	2.47	2.34	2.31	2.25	1.91	2.34	2.34	2.03	2.01	1.89
4	**W1**	0.63	0.59	0.60	0.58	0.43	0.43	0.38	0.34	0.31	0.28	0.23	0.19	0.34	0.13	0.12	0.17
5	**W1A**																
6	**W2**	0.48	0.44	0.43	0.48	0.37	0.37	0.35	0.32	0.33	0.34	0.29	0.29	0.32	0.23	0.22	0.21
7	**W2A**	0.94	0.90	0.91	0.91	0.90	0.74	0.92	0.73	0.82	0.89	0.82	0.77	0.73	0.74	0.74	0.58
8	**W2B**	0.90	0.86	0.84	0.85	0.81	0.51	0.82	0.75	0.74	0.77	0.70	0.67	0.75	0.64	0.64	0.50
9	**W2C**	0.94	0.94	0.95	0.86	0.96	0.93	0.97	0.94	0.91	0.95	0.88	0.73	0.94	0.72	0.70	0.75
10	西南角 **W3**	0.33	0.29	0.27	0.29	0.17	0.18	0.16	0.15	0.14	0.13	0.10	0.05	0.15	0.05	0.05	0.03
11	西南角 **W3A**	0.31	0.29	0.28	0.29	0.21	0.21	0.19	0.18	0.17	0.17	0.13	0.09	0.18	0.10	0.11	0.04
12	**W4**	0.44	0.48	0.42	0.48	0.40	0.39	0.37	0.33	0.31	0.37	0.24	0.27	0.33	0.23	0.23	0.11
13	**W4A**	0.42	0.40	0.41	0.40	0.36	0.37	0.36	0.31	0.31	0.36	0.21	0.28	0.31	0.18	0.16	0.19
14	**W4B**	0.43	0.44	0.45	0.45	0.40	0.39	0.40	0.37	0.37	0.37	0.28	0.32	0.37	0.30	0.28	0.23
15	厅南墙 **W5**	0.51	0.47	0.45	0.47	0.42	0.43	0.43	0.40	0.38	0.40	0.36	0.32	0.40	0.27	0.25	0.22
16	厅南墙 **W5A**	0.43	0.44	0.41	0.39	0.37	0.36	0.36	0.33	0.31	0.30	0.28	0.24	0.33	0.24	0.23	0.17
17	厅南墙 **W5B**	0.43	0.40	0.39	0.40	0.36	0.35	0.33	0.30	0.28	0.27	0.24	0.23	0.30	0.21	0.21	0.16
18	**W5C**	0.27	0.25	0.25	0.22	0.21	0.20	0.19	0.18	0.18	0.17	0.15	0.13	0.18	0.11	0.11	0.04
19	**W5D**	0.19	0.17	0.17	0.17	0.15	0.14	0.13	0.10	0.10	0.12	0.05	0.05	0.10	0.05	0.05	0.03
20	**W6**	0.38	0.37	0.38	0.37	0.32	0.31	0.31	0.28	0.27	0.25	0.23	0.21	0.28	0.15	0.13	0.13
21	**W6A**	0.33	0.35	0.33	0.33	0.26	0.25	0.23	0.18	0.21	0.19	0.15	0.15	0.18	0.14	0.14	0.03
22	**W7**	0.58	0.56	0.56	0.55	0.48	0.46	0.41	0.38	0.40	0.37	0.34	0.27	0.38	0.29	0.27	0.19
23	东南角 **W7A**	0.57	0.54	0.55	0.55	0.50	0.43	0.47	0.36	0.41	0.39	0.35	0.32	0.36	0.24	0.24	0.20
24	**W7B**	0.52	0.48	0.49	0.40	0.44	0.40	0.39	0.31	0.38	0.32	0.31	0.31	0.31	0.27	0.27	0.21
25	**W7C**	0.19	0.19	0.18	0.18	0.15	0.15	0.14	0.13	0.12	0.11	0.05	0.05	0.13	0.04	0.04	0.03
26	T1																
27	**T2**	1.35	1.25	1.38	1.34	1.34	1.36	1.37	1.30	1.29	1.28	1.15	1.17	1.30	1.13	1.12	0.90
28	**T3**	0.36	0.37	0.37	0.25	0.31	0.30	0.30	0.25	0.25	0.25	0.18	0.21	0.25	0.17	0.10	0.11
	Anode - FLOORS	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps
29	**ALL 1-7 (Floor)**																
30	**1**	1.92	1.88	1.85	1.73	1.92	1.83	1.84	1.80	1.78	1.77	1.70	1.70	1.80	1.63	1.62	1.44
31	**2**																
32	**3**	1.78	1.70	1.73	1.63	1.82	1.82	1.79	1.62	1.64	1.65	1.55	1.58	1.62	1.21	1.20	0.99
33	**4**	1.97	1.98	1.99	1.94	2.11	2.06	2.07	1.88	1.91	1.94	1.78	1.73	1.88	1.55	1.51	1.51
34	**5**	1.94	2.03	2.03	1.97	2.17	2.02	2.15	1.93	2.02	1.99	1.95	1.64	1.93	1.97	1.87	1.67
35	**5A**	1.80	1.89	1.92	1.81	1.96	1.96	1.96	1.86	1.82	1.64	1.72	1.73	1.86	1.42	1.43	1.33
36	**6**	0.97	1.05	1.04	1.00	1.02	1.03	1.05	1.02	0.91	0.94	0.90	0.93	1.02	0.58	0.58	0.66
37	**7**	1.55	1.53	1.56	1.45	1.53	1.53	1.48	1.44	1.44	1.43	1.33	1.31	1.44	1.17	1.16	1.20
	Cathode																
38	**ALL C**	2.85	2.88	2.81	2.65	2.93	2.92	2.94	2.78	2.72	2.72	2.65	2.70	2.78	2.68	2.70	2.48
39	**C1**	2.14	2.12	2.07	2.07	2.19	2.07	2.14	2.02	2.04	1.99	1.93	1.96	2.02	2.13	2.12	1.88
40	**C2**	1.03	1.01	1.01	1.01	1.01	1.00	1.00	0.89	0.98	0.98	0.96	0.93	0.89	0.95	0.94	0.71

9.0 A nearby Villa without MPS System Installed



This Villa is located at Block 35 Lot 2 has No MPS System installed

Water seepage at the junction of exterior wall and floor slab was observed at Block 35 Lot 2

Water seepage was noticed at the junction of columns and floor slab of Block 35 Lot 2 Villa

Water ponding was observed inside a damaged electrical floor outlet of Block 35 Lot 2 Villa

Water seepage was observed at the exterior wall
of Block 35 Lot 2 Villa

Patches of water was observed at the basement floor slab
of Block 35 Lot 2 Villa

10.0 Conclusion

Based on the actual current readings presented in Section 8 of this report; the overall anodes and cathodes readings were plotted in a graphical format from 16 July to 22 December 2009as shown in figure 5.

The trends of electrical current are downwards and it is expected that it will continue to go down in the coming months. This graphical result are similar to other successful MPS System installations such as in Walthamstow London Underground Stations, refer to Figure 6.

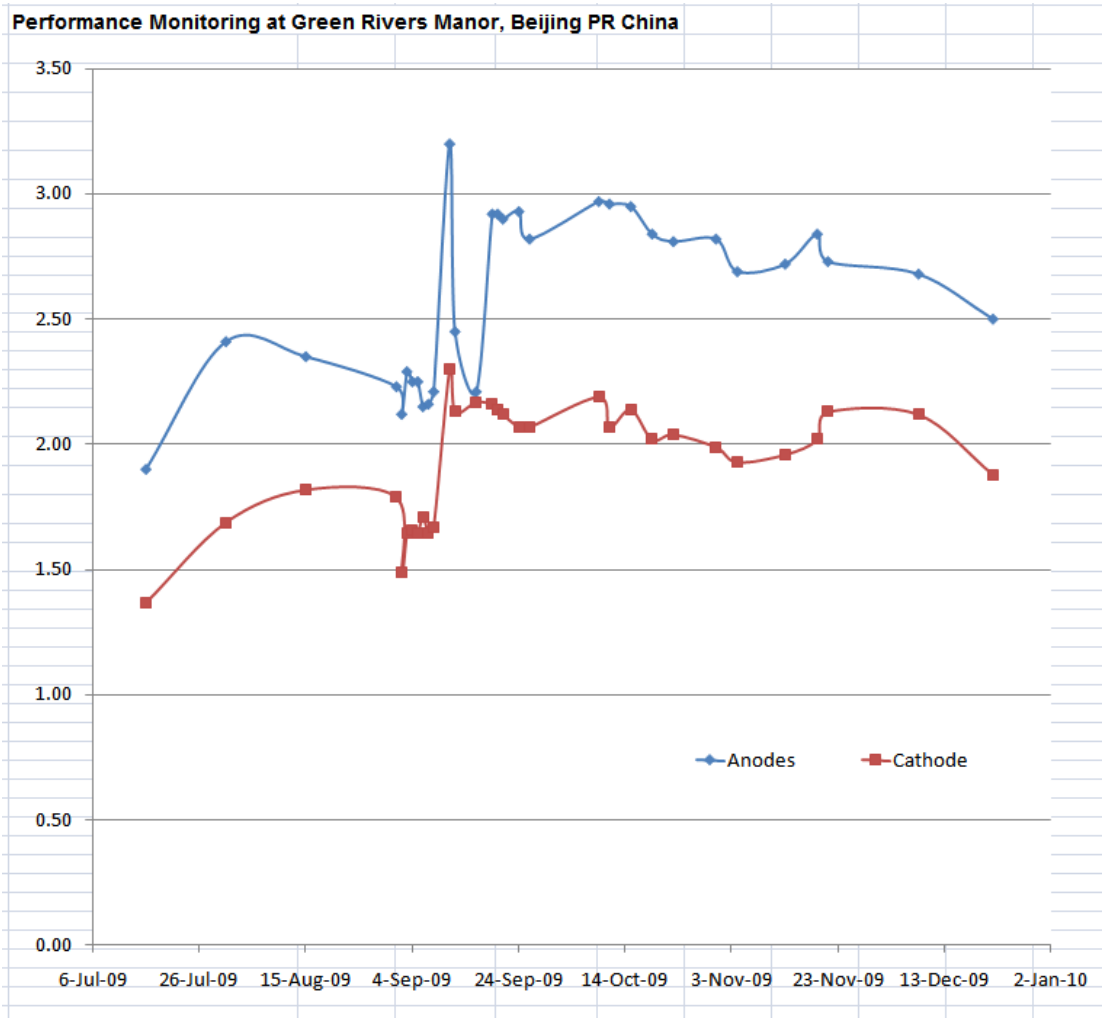


Figure 5

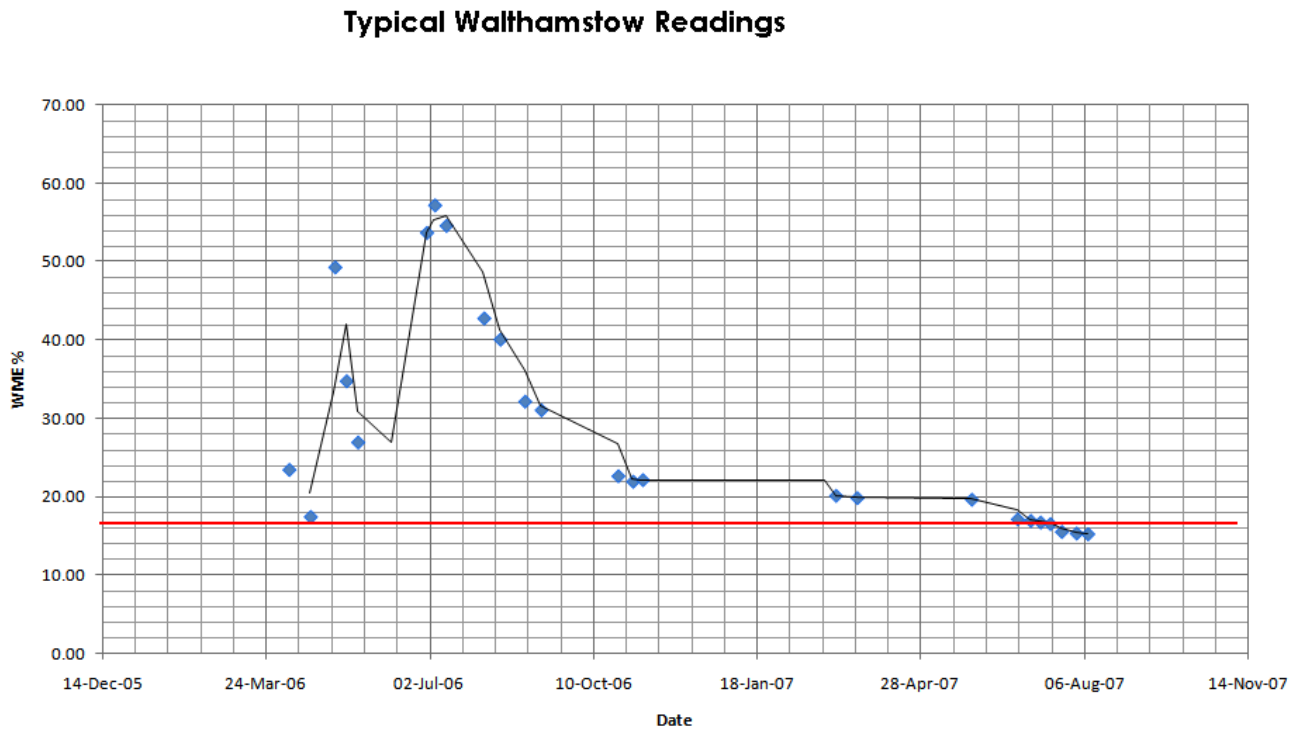


Figure 6

Referring to the above Walthamstow Readings (Figure 6), it takes approximately 7 months (from 24-Mar-06 to 10-Oct-06) to reduced the reading from its initial stage.

Whilst in Green Rivers Villa (Figure 5), it is now on its 5th month and it is clearly shown that the drying out process may probably take more or less similar to Walthamstow which is approximately 6th or 7th months to reach its initial dry stage level.

Current Draw on LCD Screen

LCD Reading which represents electrical current drawn in the structure has also shown a downward trend. A less electrical current within the concrete structure represents less conductivity, therefore the concrete walls and floor slab are in a continuous drying out process, refer to Figure 7.

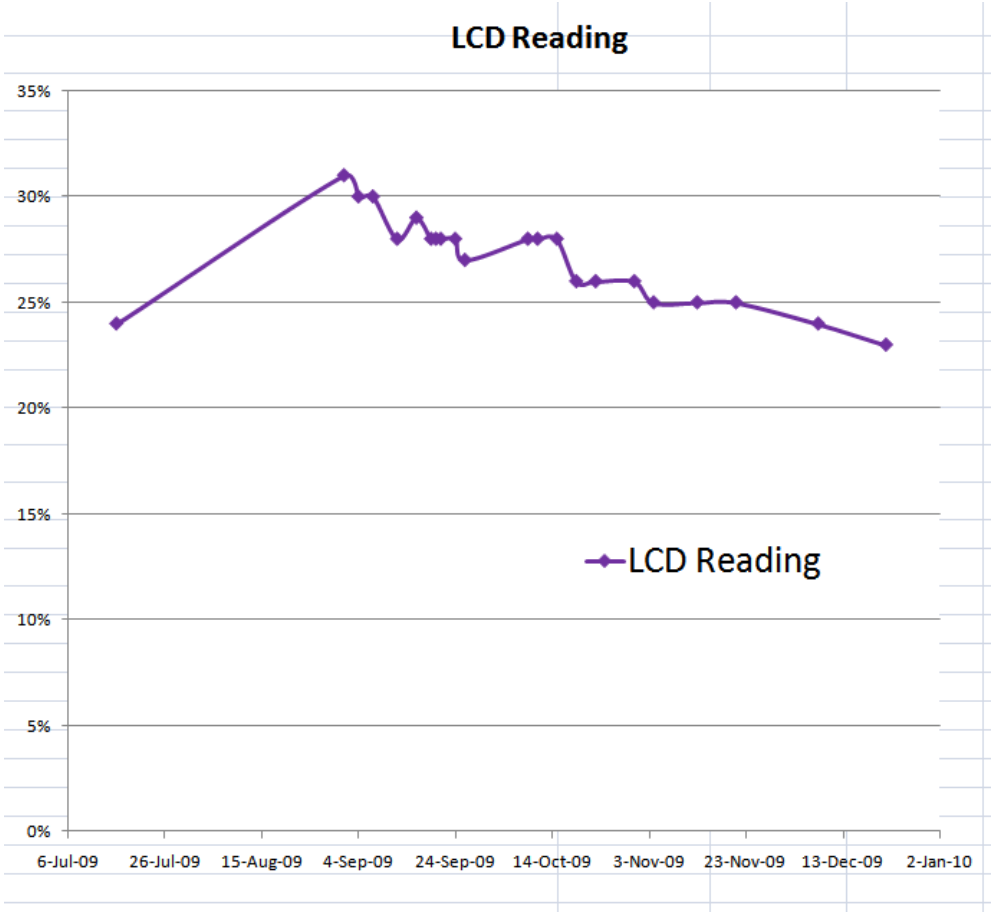


Figure 7

We therefore conclude that based on:

1) Visual inspection conducted at the site; it was observed on 22 December 2009 that the basement of Block 39 Lot 17 is in a very dry condition.

2) The comparison between Block 39 Lot 17 against Block 35 Lot 2; it was observed that the basement of Block 39 Lot 17 (which has MPS System installed) is much dryer and low humid condition than Block 35 Lot 2.

3) The graphical result of the performance of MPS System at Green Rivers Villa, Block 39 Lot 17 is satisfactory.