ANNEX 1 –Shading Impact Upon Fanling Golf Course West of Fan Kam Road

(Rev.0)

A. THE IMPORTANCE OF SUNLIGHT TO GOLF COURSES

Plants use light the same way animals use food – to fuel the chemical reactions that keep them alive, and different types of plants require different levels of light.

Golf course turfgrass requires a large amount of direct sunlight for optimum growth and development. There is no golf turfgrass variety developed that performs well when deprived of sufficient light, and lack of sufficient light is an important stressor that weakens turf, making it more susceptible to attack by pests, traffic, and other stressors.

The proposed PHD will cause serious adverse impact to the golf turfgrass on the west side of Fan Kam Road as the very high tower blocks will directly shade the 18th hole of the Old Course as well as some portions of several holes on the New and Eden courses that are used for the Hong Kong Open (HKO).

B. HKGC TURFGRASS DETAILS

All the turfgrasses at Hong Kong Golf Club (HKGC), Fanling (which includes Zoysia grass, Bermuda grass, Paspalum and Carpet grass) require a minimum of 6-8 hours of full sunlight, daily, to grow at their optimum. Full sunlight means no shading or cloudy conditions. Under ideal conditions 9-10 hours is most desired.

In general, all 3 courses have the following turfgrasses:

- Greens: Bermuda grass
- Tees: Mix of Bermuda grass / Paspalum
- Fairways:
  - (Eden/New) - Mix of Zoysia grass / Bermuda grass
  - (Old) - Mix of Paspalum / Bermuda grass
- Rough and Areas under Trees: Carpet grass

The HKGC turfgrasses in order of most to least sunlight requirements are:

1. Bermuda grass (most)
2. Paspalum
3. Zoysia grass
4. Carpet grass (least)

C. SHADE IMPACTS

Shade cast by the proposed PHD high rises will cause a significant reduction in the number of hours of light the turfgrass receives each day. When turfgrass plants receive less than optimal light, they begin to change almost immediately at the biochemical and molecular levels, resulting in lower rates of respiration and photosynthesis and slower plant growth. These invisible changes soon bring about some obvious changes in the anatomy and appearance of turf including:

- Plants become elongated (taller), but stems are thinner and weaker. Internodes are longer, and stolons are fewer. Turf thins as a result.
- Root growth is decreased significantly. Shoot growth, shoot density and tillering are reduced, too.
- Leaves become darker, fewer in number, narrower and more succulent (more moisture is retained).
- The leaf's waxy protective outer layer, the cuticle, becomes thinner.

The resulting turfgrass plants are weakened considerably, and turf quality is reduced significantly. The succulent leaves with their thinner cuticle are more susceptible to damage from traffic, equipment, and disease. The depleted root system and lower energy reserves make it more difficult for the plant to recover from any type of injury from heat, cold, excessively dry or wet conditions, or disease. Weeds become more common because the turf plant is unable to compete effectively with them for moisture, light and nutrients. In addition, plants grown in shade grow more slowly.

Shade affects turf management and golf course playability on a larger scale and causes increased weed pressure, because of the increased susceptibility of shade-grown turf to disease.

Additionally, shade produces some specific problems, depending on the turf type and turf height of cut, namely:

- shade leads to bare turfgrass spots;
- greens in partial shade will suffer more from moss, algae, weeds, and disease;
- turf will be thinner and more susceptible to damage from heavy golfer and spectator traffic at tournament events; and
- shaded areas will be wetter which reduces golf play quality and potential.

The best turf conditions occur when the turfgrass receives full sunlight every day of the year. Any period during the year there are undesirable growing conditions the turf will be affected. Turfgrass conditions can rapidly decline with even one week of no direct sunlight. Recovery time will depend on the state of condition prior to the downturn. Once turfgrass starts to have insufficient sunlight visual thinning will be seen within 2-3 weeks' time and if low light conditions continue, further decline will persist to a point where the grass becomes spindly and within 2 months weeds and algae may start to appear. The greens will degrade quicker due to the relatively higher stress applied through the various maintenance practices, the fairways will take longer to degrade since they're cut higher, but in time the result will be the same.

D. QUANTITATIVE SCIENTIFIC SHADE ASSESSMENT AND IMPACTS

Using sun-path analysis computer programmes, HKGC have modelled very precisely the impact of shading by the proposed PHD high rises on the remaining golf holes including those used for the HKO.

Figures A1-1 to A1-33, (following page 4) illustrate the results for the Winter Solstice, the Spring and Autumn Equinoxes, and the Summer Solstice.

Table 1 summarizes the result for several key holes.

The results for Midwinter are particularly important because the HKO is normally held within one month either side of Midwinter (the exact timing of HKO is according to the calendar of the DP World Tour and is outside the control of HKGC).

The results demonstrate that there will be serious adverse effects on several remaining holes as follows:

- **Old Course Hole #18 (Green and Fairway):** This will receive less than 6.5 hours/day of direct sunlight for the entire year, and less than 5 hours/day for 6 months (between equinoxes). This effectively means that the grass will quickly deteriorate to a condition whereby it cannot continue to be played as a golf hole.
- **Practice Putting Green (PPG) at Clubhouse** (Important role during HKO): This will receive less than 7 hours/day of direct sunlight for 6 months of the year (between equinoxes), and less than 6 hours/day for about 3 months (early November to early February). This will seriously adversely impact the PPG turfgrass. The PPG has a vital role to play during the HKO (normally played within a month of Midwinter) because the professional golfers practice there immediately prior to starting their round. The professionals expect that the PPG will have exactly the same playing conditions and putting 'speed' as the greens out on the course, but that will not be the case due to the serious adverse impacts on the PPG turf due to the shading described above. It is anticipated that that such

a scenario will be unacceptable to the DP World Tour. It will also adversely impact the ability of the PPG to serve its purpose for the regular golfers for much of the year.

Table 1 Number of Direct Sunlight Hours per Day

	Colour code: Enough sun (>8Hrs) / Borderline (6-8Hrs) / Too little sun (<6Hrs)			
	TIME			
LOCATION		**Midsummer** (21 June) Sunrise: 05:40 Sunset: 19:10 Sunlight Hours: ~13.5hrs	**Equinoxes** (21 March / 21 September) Sunrise: 06:26 / 06:11 Sunset: 18:34 / 18:20 Sunlight Hours: ~12hrs / ~12hrs	**Midwinter** (21 December) Sunrise: 06:58 Sunset: 17:44 Sunlight Hours: ~10.5hrs
	Old Course - Hole #18 (Green & fairway)	**~6.5hrs (12:00-18:30)**	**~5hrs (13:00-18:00)**	**~3hrs (14:00-17:00)**
	Eden Course - Hole #1 (Tee & fairway)	**~8.5hrs (10:00-18:30)**	**~7hrs (11:00-18:00)**	**~5hrs (12:00-17:00)**
	Eden Course - Hole #7 (Green & fairway)	Not Affected	**~8hrs (10:00-18:00)**	**~6hrs (11:00-17:00)**
	Eden Course - Hole #18 (Green)	Not Affected	**~8hrs (10:00-18:00)**	**~6hrs (11:00-17:00)**
	New Course - Hole #1 (Tee & fairway)	Not Affected	Not Affected	**~6hrs (11:00-17:00)**
	New Course - Hole #18 (Green)	Not Affected	Not Affected	Not Affected
	Practice Putting Green	Not Affected	**~7hrs (11:00-18:00)**	**~5hrs (12:00-17:00)**

*Last time of direct sunlight is calculated to be 30-45 minutes before actual sunset due to effect of surrounding topography & vegetation.

- **Eden Hole #1 (Tee and Fairway)**: This is part (Hole #1) of the HKO Composite Course. Like the PPG, this will receive less than 7 hours/day of direct sunlight 6 months of the year (between equinoxes), and less than 6 hours/day for about 3 months (early November to early February). This will seriously adversely impact the turfgrass, which will in turn compromise regular golf play throughout the year and seriously compromise turf quality during the HKO, to a level that is highly likely to be unacceptable to the DP World Tour. Regular play for average golfers will also be compromised for much of the year.
- **Eden Hole #7 (Fairway & Green)**: This is part (Hole #3) of the HKO Composite Course. This will receive less than 8 hours/day for 6 months (between equinoxes) and less than 7 hours for about 3 months (early November to early February) which is the period when the HKO is normally held. The #7 green, in particular, will suffer as a result and the turfgrass quality will be reduced to a level that will be unacceptable to the DP World Tour. Regular play for average golfers will also be compromised for much of the year.
- **Eden Hole #18 (Green)**: This is part (Hole #18) of the HKO Composite Course. Like Eden #7, this will suffer from less than 8 hours/day for 6 months (between equinoxes) and less than 7 hours for about 3 months (early November to early February) which is the period when the HKO is normally held. The 18th green is the single most important green in the HKO, as it is where the tournament winner is often decided, and anything less than perfect turf quality will be unacceptable to the DP World Tour. Regular play for average golfers will also be compromised for much of the year.
- **New Hole #1 (Tee & Fairway):** This is part (Hole #17) of the HKO Composite Course. This will suffer from less than 7 hours/day for about 2 months (late November to late January) which is the period

within which the HKO is normally held. Again, the resultant lowering in turf quality is highly likely to be unacceptable to the DP World Tour. Regular play for average golfers will also be compromised.

E. ADVERSE IMPACTS OF POOR VENTILATION

The adverse impacts caused by shading will be further exacerbated and compounded by the adverse impacts of poor air ventilation resulting from the blockage caused by the proposed PHD high rises. Although the precise changes in air ventilation at ground level are more difficult to quantify than the precise reductions of direct sunlight, the total adverse impact on the turfgrass from shading and poor air ventilation will undoubtedly be qualitatively greater than from the shading alone.

F. NEGATIVE SYNERGY EFFECTS CREATE MAJOR RISK TO HONG KONG OPEN

Thus, temperature and shade direct impacts, in combination with the loss of car and coach parking and logistics and back up areas from the removal of the 8 Old Course Holes east of Fan Kam Road, it can be seen the CEDD's proposed PHD poses a major risk to the future of Hong Kong's ability to host its oldest golf tournament, the world's second oldest continuously running international golf tournament, and Hong Kong's most internationally significant golfing event, as no other golf course in Hong Kong could host such a significant international event.

References

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Figure A1-01 – Sun Path Diagram – Winter Solstice – 0800 hrs

Figure A1-02 – Sun Path Diagram – Winter Solstice – 0900 hrs

Figure A1-03 – Sun Path Diagram – Winter Solstice – 1000 hrs

Figure A1-04 – Sun Path Diagram – Winter Solstice – 1100 hrs

Figure A1-05 – Sun Path Diagram – Winter Solstice – 1200 hrs

Figure A1-06 – Sun Path Diagram – Winter Solstice – 1300 hrs

Figure A1-07 – Sun Path Diagram – Winter Solstice – 1400 hrs

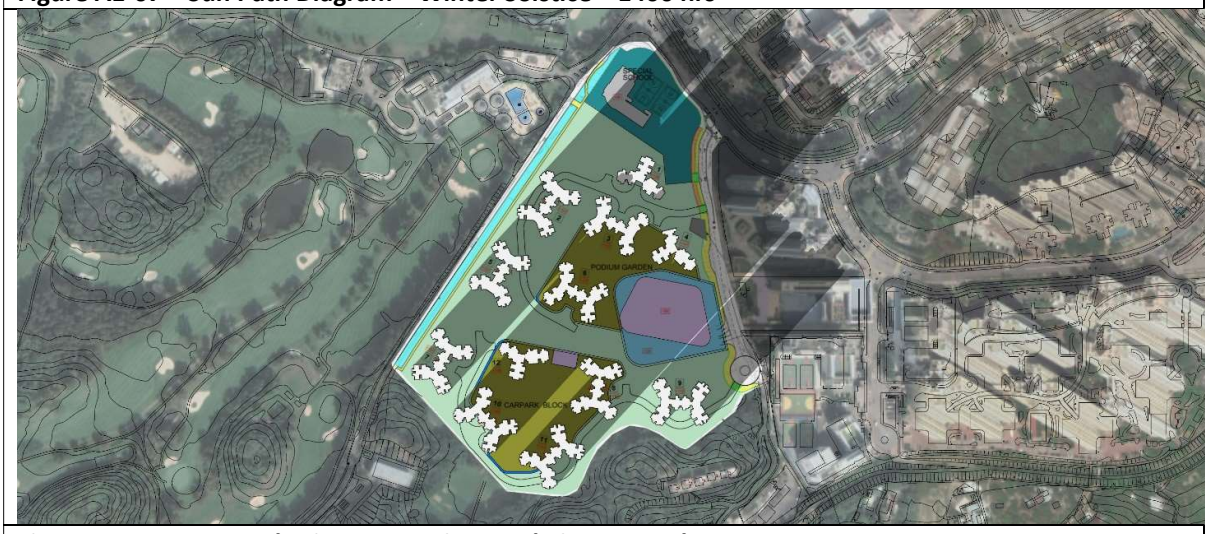

Figure A1-08 – Sun Path Diagram – Winter Solstice – 1500 hrs

Figure A1-09 – Sun Path Diagram – Winter Solstice – 1600 hrs

Figure A1-10 – Sun Path Diagram – Winter Solstice – 1700 hrs

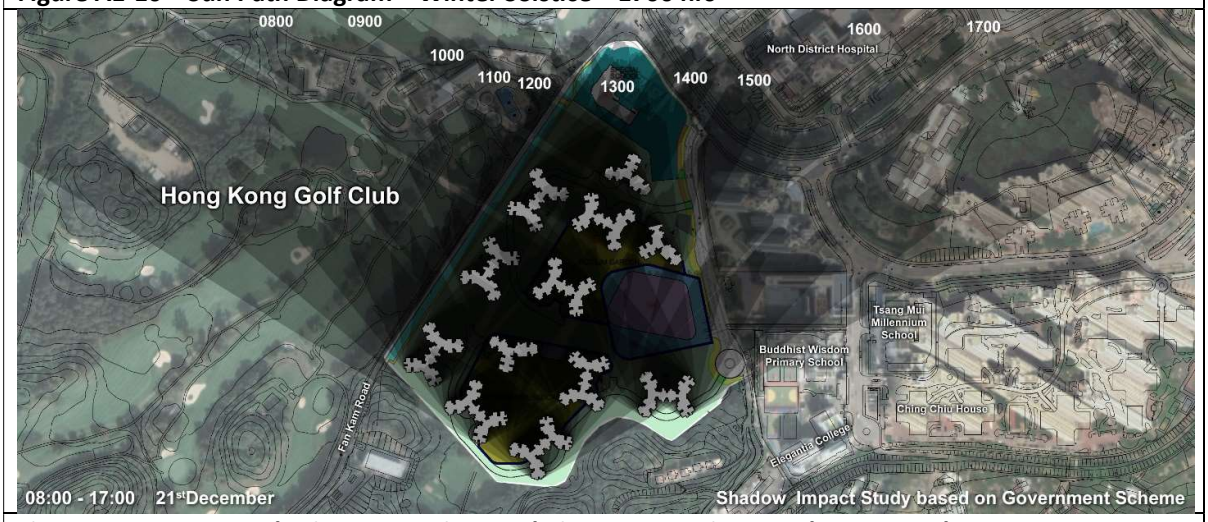

Figure A1-11 – Sun Path Diagram – Winter Solstice – Composite 0800 hrs to 1700 hrs

Figure A1-12 – Sun Path Diagram – Spring & Autumn Equinoxes – 0800 hrs

Figure A1-13 – Sun Path Diagram – Spring & Autumn Equinoxes – 0900 hrs

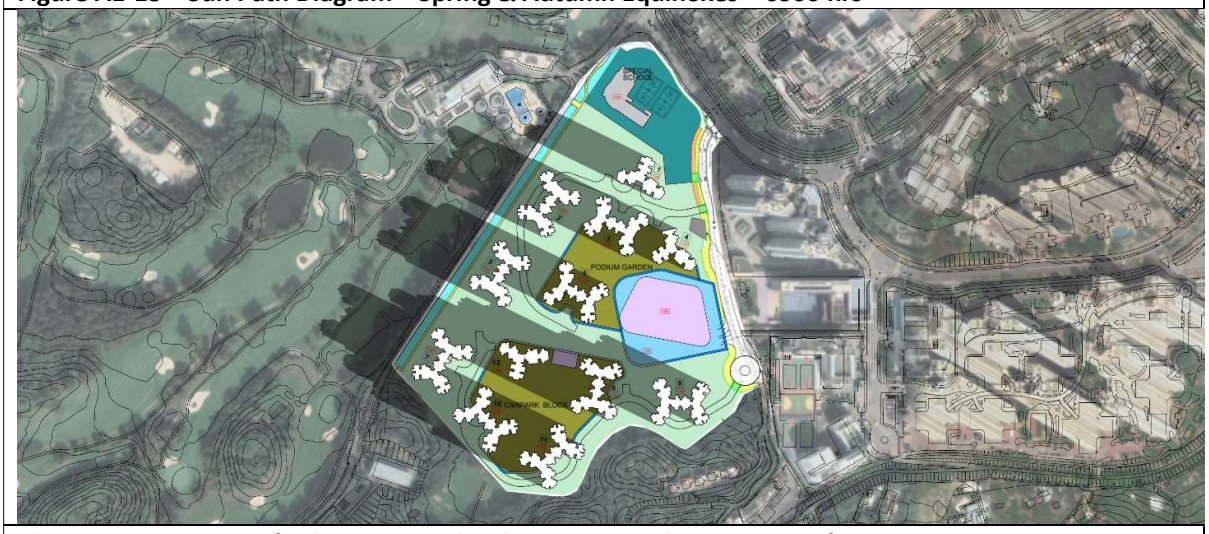

Figure A1-14 – Sun Path Diagram – Spring & Autumn Equinoxes – 1000 hrs

Figure A1-15 – Sun Path Diagram – Spring & Autumn Equinoxes – 1100 hrs

Figure A1-16 – Sun Path Diagram – Spring & Autumn Equinoxes – 1200 hrs

Figure A1-17 – Sun Path Diagram – Spring & Autumn Equinoxes – 1300 hrs

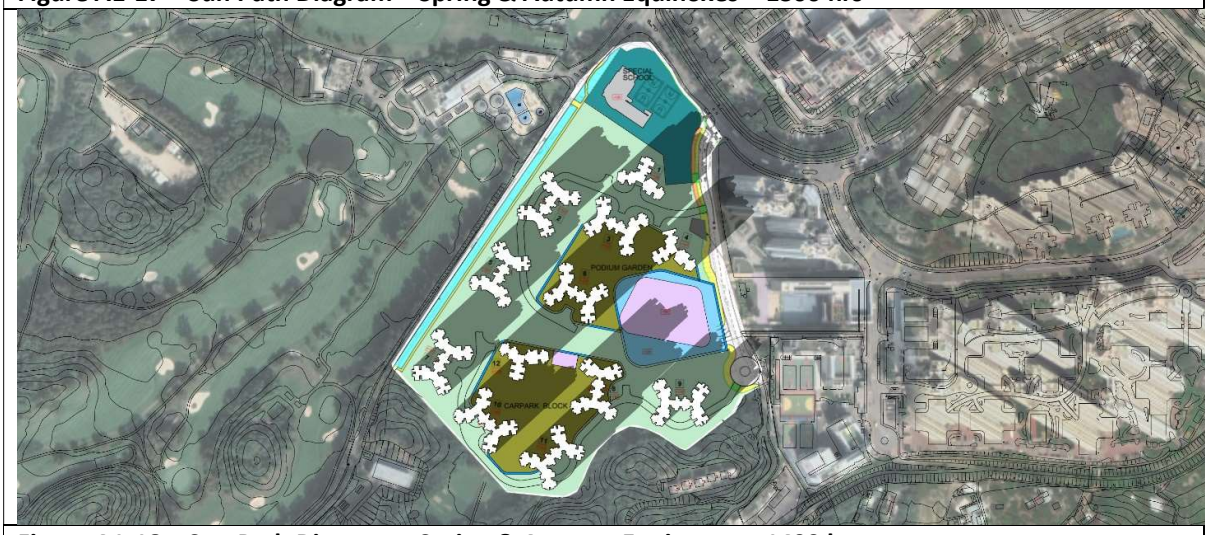

Figure A1-18 – Sun Path Diagram – Spring & Autumn Equinoxes – 1400 hrs

Figure A1-19 – Sun Path Diagram – Spring & Autumn Equinoxes – 1500 hrs

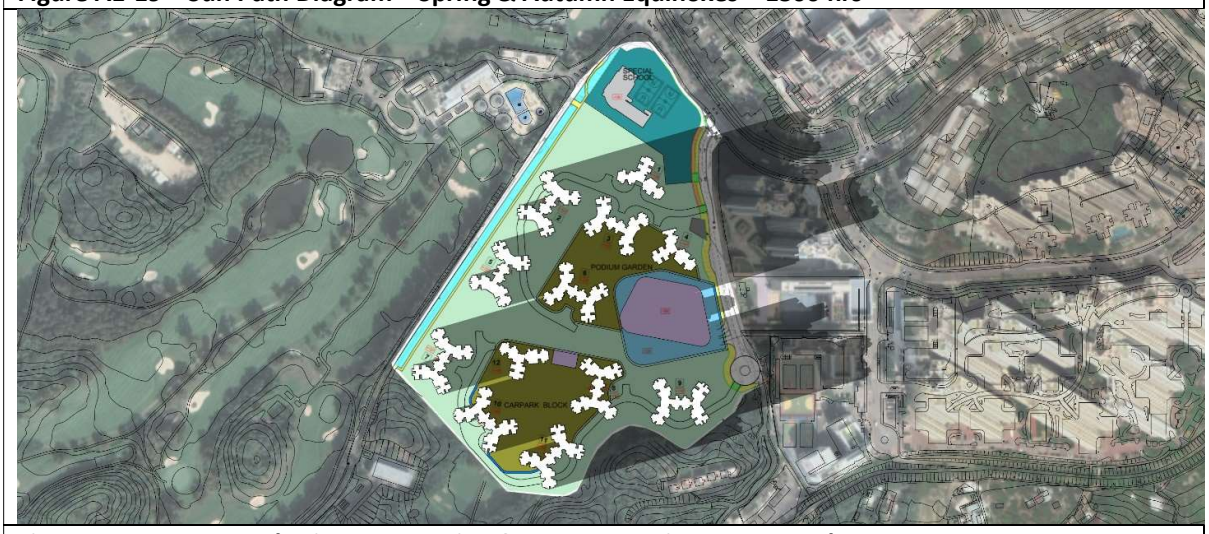

Figure A1-20 – Sun Path Diagram – Spring & Autumn Equinoxes – 1600 hrs

Figure A1-21 – Sun Path Diagram – Spring & Autumn Equinoxes – 1700 hrs

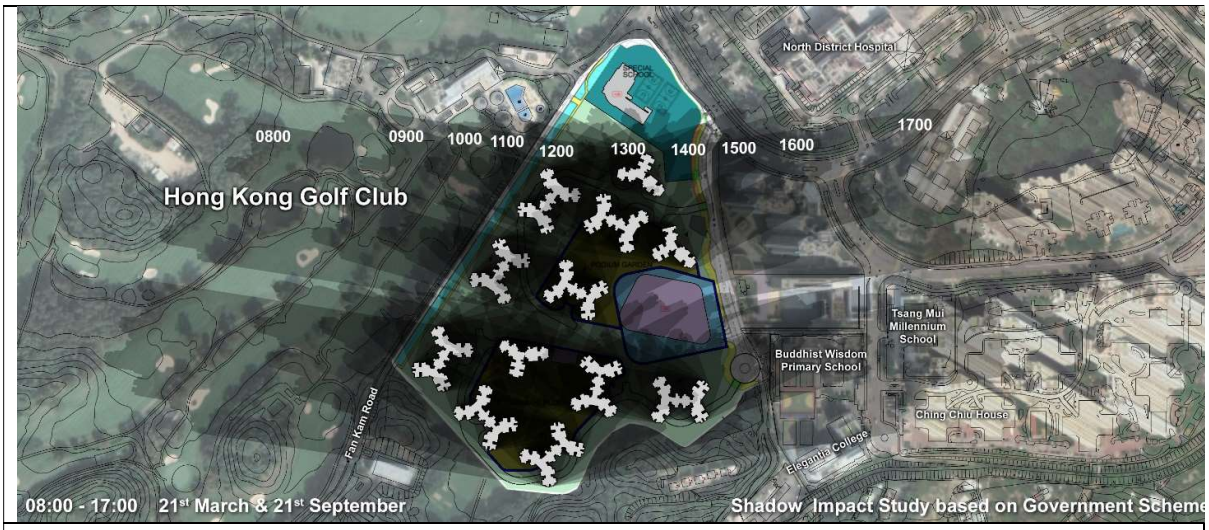

Figure A1-22 – Sun Path Diagram – Spring & Autumn Equinoxes – Composite 0800 hrs to 1700 hrs

Figure A1-23 – Sun Path Diagram – Summer Solstice – 0800 hrs

Figure A1-24 – Sun Path Diagram – Summer Solstice – 0900 hrs

Figure A1-25 – Sun Path Diagram – Summer Solstice – 1000 hrs

Figure A1-26 – Sun Path Diagram – Summer Solstice – 1100 hrs

Figure A1-27 – Sun Path Diagram – Summer Solstice – 1200 hrs

Figure A1-28 – Sun Path Diagram – Summer Solstice – 1300 hrs

Figure A1-29 – Sun Path Diagram – Summer Solstice – 1400 hrs

Figure A1-30 – Sun Path Diagram – Summer Solstice – 1500 hrs

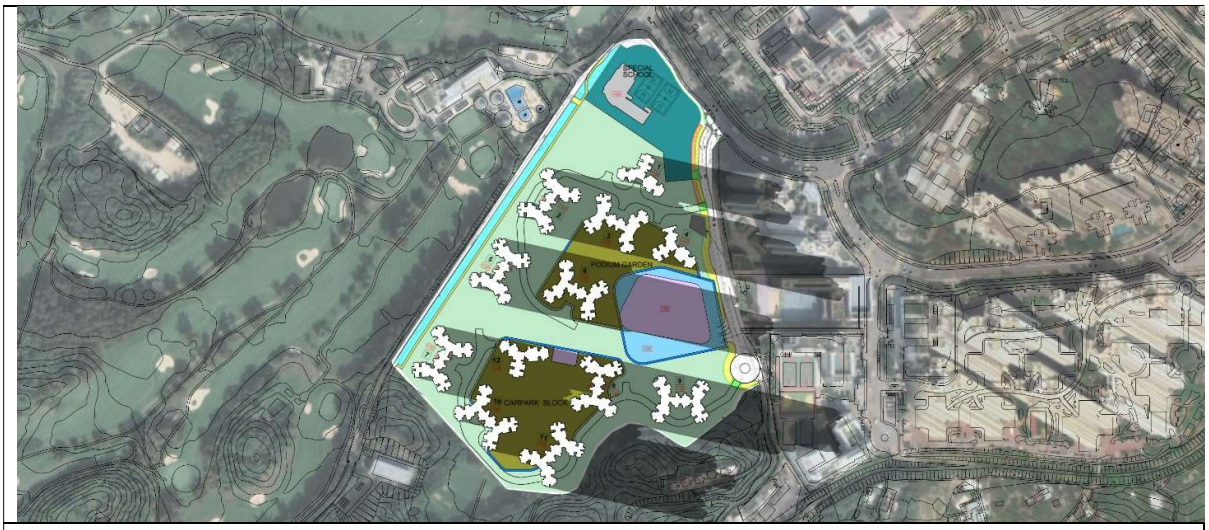

Figure A1-31 – Sun Path Diagram – Summer Solstice – 1600 hrs

Figure A1-32 – Sun Path Diagram – Summer Solstice – 1700 hrs

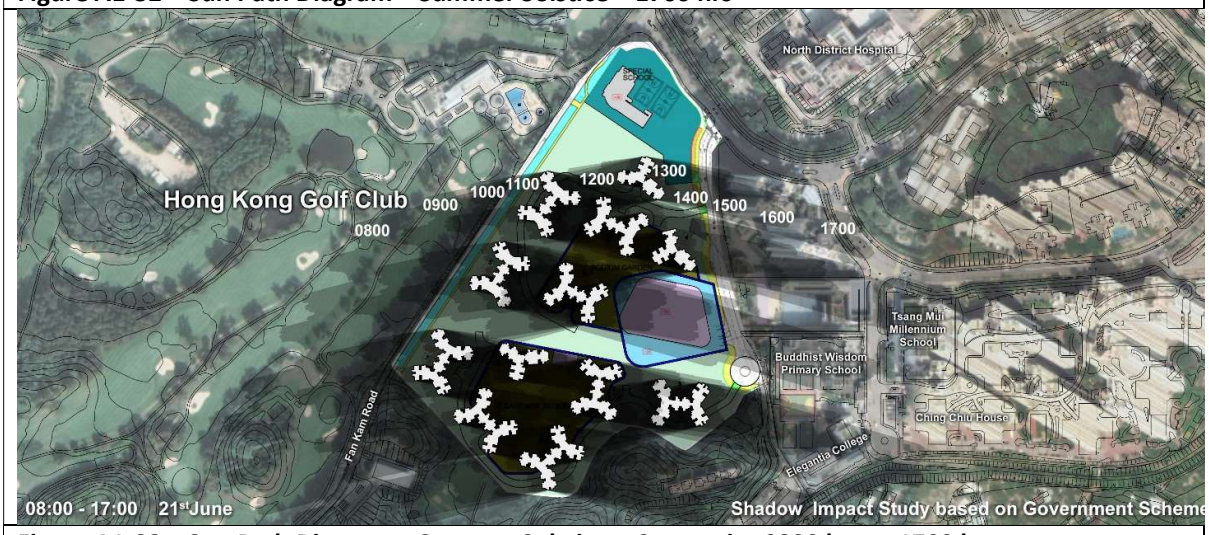

Figure A1-33 – Sun Path Diagram – Summer Solstice – Composite 0800 hrs to 1700 hrs