1.6.0 Pool

1.6.1 Introduction

Broadway Plaza offers its residents aquatic fitness through the pool facility. Complete with a lap pool, wading pool, and jacuzzi, the pool area provides for multiple building system study. Specialized tile patterns in shades of blue, gray, and beige line the floor and walls. Ceilings are blue painted backer board. Large indentations have been cut into the ceiling above the wading pool and jacuzzi areas. Within the existing design, the lap pool may be lit from above by three "ridge type" skylights with accompanying splayed skylight wells. Upon completion of a daylight study, incorporated within my Mechanical Breadth, this configuration was changed to one large sloped skylight with splayed well. Additionally, the effects of daylighting on energy savings are also included in the Construction Management Breadth.
Please refer to 3.0 Mechanical Breadth and 4.0 Construction Management Breadth for cross-reference for daylighting design within the pool area.

1.6.2 Space Layout

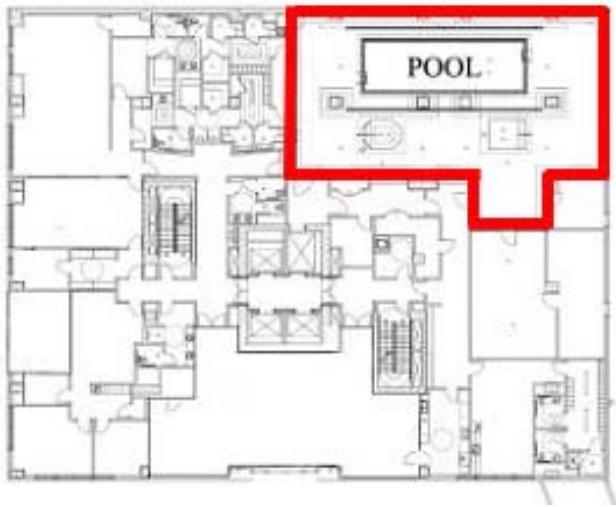


Figure 1.6.2a: Location of Pool Within 3rd Floor

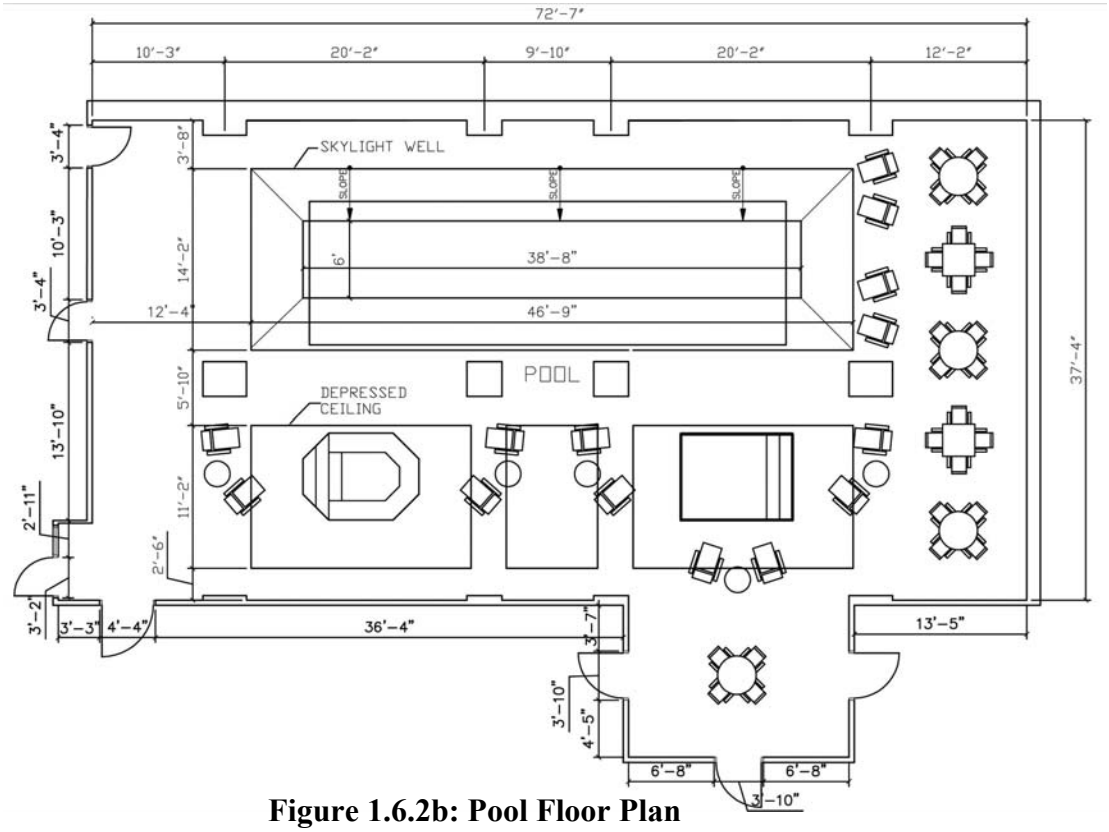


Figure 1.6.2b: Pool Floor Plan

1.6.3 Architectural Surfaces

Floor Finishes

Porcelain Tile
Pattern: 2"x2"
Color: Porcelain
Reflectance: 80.0%

Porcelain Tile
Outer Edge Accent
Color: As Shown
Reflectance: 48.0%

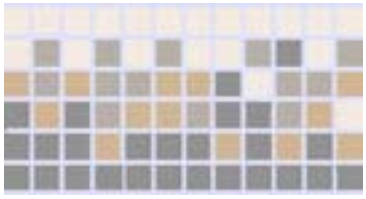
Porcelain Tile
Inner Edge Accent
Color: As Shown
Reflectance: 68.0%

Wall Finishes

Porcelain Tile
Pattern: 2"x2"
Color: Porcelain
Reflectance: 80.0%

Paint-P5
MFG: Benjamin Moore
Color: Sky
Finish: Latex Eggshell
Reflectance: 76.0%

Porcelain Tile
Accent Along Floor
Color: As Shown
Reflectance: 59.0 %



Ceiling Finishes

Paint-P5
MFG: Benjamin Moore
Color: Sky
Finish: Latex Eggshell
Reflectance: 76.0%

Skylight Well-Paint-P7
MFG: Benjamin Moore
Color: Cloud Nine
Finish: Latex Eggshell
Reflectance: 86.1%

Glass Type

Glazing Description	Transmittance		ASHRAE U-Value		Shading Coefficient	SHGC
	Visible Light	UV	Winter Nighttime	Summer Daytime		
Sunlite Insulating Glass: Heat Mirror TC 88 Triple Glazing Glass, 1 1/4" Overall Depth	63%	0.05%	0.13 Btu/(hr* sqft* degree F)	0.12 Btu/(hr* sqft* degree F)	0.55	0.48

1.6.4 Design Concept

Design Goals

Residents shall find both recreation and relaxation within the pool area. The facility calls for a relaxed and private atmosphere that molds to the moods of those using it. During any one time, only a few residents will be using the facility. Therefore, it is important that these residents are pleased with their surroundings. In order to accomplish this, the system must be flexible and easy to configure. Lighting controls, are thus, as important as the lighting itself. The residents are not the only people to which the pool lighting must be pleasing. Maintenance personnel do not want to be plagued by problems with lighting maintenance. Luminaires must be kept where relamping does not cause major complications, and lamp life should be long enough to avoid numerous lamp changes.
As always, enough light must be delivered to the critical surfaces. A pool can be hazard for slipping injuries, regardless of the light levels. Thus, levels must be maintained at the recommended illuminances to further promote safety. These include not only light levels, but the variation of light as well. A clear delineation of the pool from the deck should also be provided.

Conceptualization and Sketches

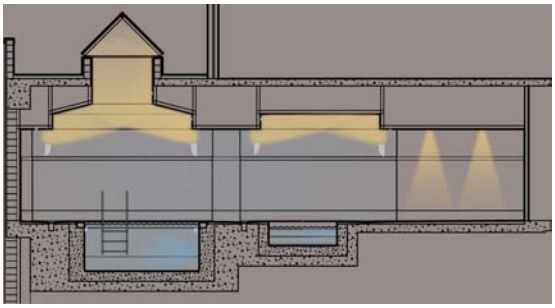


Figure 1.6.4a: North-South Section

As recommended by the USA Swimming Association and ASHRAE RP-6-01, indirect lighting is employed- mounted along the indentations in the ceilings. These pendants, as seen in Figure 1.6.4a-b, will direct light into the bright indentations, which will then reflect light to the pool surfaces. Relamping should not be a problem with this scenario as the pendants are located to the sides of the pool. No water surface will need to be covered or the pool drained in order to relamp. Meanwhile, direct lighting is provided to the lounge areas and deck by lensed downlights. For improved safety, underwater luminaires are used to minimize veiling reflections on the surface of the water and to enhance visibility for swimmers within the water. A fiber optic system satisfies this application. By using fiber optics, relamping does not need to take place within the pool itself. Instead, relamping will occur at the fiber optic source within the pool service room.

The pool lends itself to two different lighting scenarios depending on the time of day. The skylight supplies a large amount of light during the daytime hours. In many cases, enough light will be provided to eliminate the need for electric light above the lap pool during these times. The other pool areas, meanwhile, require dedicated lighting to illuminate them at all times. During the evening hours, the pool area will become more private. With the integration of skylighting during the day, swimmers feel as if they are swimming in the outdoors. Likewise, during the night hours, the room remains at much lower light levels- primarily lit by a combination of the pool itself and downlighting. This increases the privacy of the space and creates a quiet and soothing atmosphere filled with the reflections of the pool water. Preset scenes are made available to achieve these moods as well.

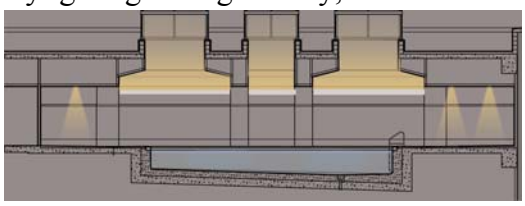


Figure 1.6.4b: West-East Section

1.6.5 Design Criteria

- Color Appearance (and Color Contrast) (Somewhat Important)
  The rendering of colors within a swimming pool area is important to create a strong contrast between backgrounds and the immediate task of swimming. Color contrast should make distinguishing points in the pool as well as along the pool deck quite easy.
- Daylighting Integration and Control (Important)
  While daylight from the provided skylight is desirable, unwanted glare from direct and reflected light can cause performance and safety problems. Windows are the largest cause of glare problems. However, the existing and new design do not utilize windows, and thus, this concern may be negated.

- Direct Glare (Very Important)

  As mentioned with the daylight, direct glare can cause disorientation and discomfort for swimming recreationally. It also has the potential to hinder the vision of someone overseeing the activity of the pool area.
- Light Distribution on Task Plane (Uniformity) (Important)

  The luminance of the horizontal swimming plane should be uniform across the pool to easily distinguish safety concerns and to avoid distraction for the swimmer. While swimming, swimmers may become distracted by changes in luminance at different points along the water's surface. Additionally, without an even distribution of light along the pool floor, slippery surfaces and other walking hazards can be left unseen. Similarly, the pool, itself, must be set apart from the pool deck to avoid the hazard of slipping into the pool.
- Modeling of Faces or Objects (Important)

  While horizontal luminance is of primary concern, the modeling of faces and objects for safety reasons must not be overlooked.
- Reflected Glare (Very Important)

  Reflected glare is a primary safety and functional concern of the swimming pool area. As the water surface acts as a highly specular surface, light falling upon the plane can cause glare and reduce the ability to see objects on the water's surface or beneath it. The reflected glare from wet surfaces can also decrease a visitor's ability to perceive potential slipping hazards. This is especially true concerning young children who may be running around in the area. Therefore, indirect lighting, which minimizes glare, is recommended by the IESNA.
- Shadows (Important)

  Unwanted shadows along the pool periphery as well as within the pool itself can create a safety hazard for swimmers.
- Maintenance (Important)

  Proper maintenance of pool luminaries must be considered in any design. As fixtures will repeatedly come in contact with direct water or water vapor within the air, each fixture must be corrosion resistant. All luminaries are required by code to be UL wet-rated to satisfy these criteria. If luminaries are placed directly above the pool, changing lamps after burnout could cause major complications. If a lamp is not immediately replaced, the hindrance of the uneven illuminance as well as safety issues may be of concern. However, changing these fixtures can become even more complicated as maintenance personnel must elevate themselves above the pool's surface, possibly forcing the drainage of the pool. Therefore, fixtures should be located away from the pool surface to avoid maintenance concerns.
- Illuminance (Horizontal)

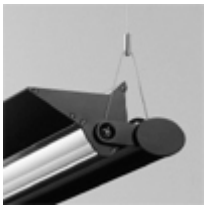
  As a multidirectional ground-level sport, swimming demands well-distributed horizontal illumination. Under the IESNA RP-6-01, Broadway's Plaza recreational swimming designation (Class IV) demands 30 fc illuminance maintained over the pool surface. The pool deck should be lit to 20 fc at 3 ft above the floor to provide enough light for safety concerns. The overall design of the pool area should have a coefficient of variation (CV), or weighted average of relevant illuminance values, of 0.3 or less.

- Illuminance (Vertical) (Important)

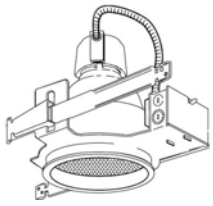
Although vertical illuminance does not affect the act of swimming, maintaining a value of 3 fc along the face is still important.

1.6.6 Equipment

Luminaire Designation	Description	Mounting	Lamp		Ballast/ Transformer	CRI	CCT	Volts	Watts	Quantity	Comments
			#	Type							
EX1	Universal-mounting LED exit sign, single face, red letters, w/ die-cast alum. housing	Wall/ Ceiling		LED	N/A	N/A	N/A	120	10	3	
EX2	Universal-mounting LED exit sign, double face, red letters, w/ die-cast alum. housing	Wall/ Ceiling		LED	N/A	N/A	N/A	120	10	1	
FP4	Indirect fluorescent lensed pendant w/ alum. housing,silicon gasket, and clear reflector, UL wet label	Pendant	1	F54/T5/830/HO	DIM-ELECTRONIC	85	3000	120	122 (2 lamp ballast)	40 (20-"2 lamp ballasts")	Luminaire: Elliptipar 164 Lamp: GE Ballast: Lutron Eco 10%
FD5	7" Dia. vertical lamp CF downlight w/ semi-specular reflector with white cone and fresnel lens, UL wet label	Recessed	1	CFTR32W/GX24q/830	DIM-ELECTRONIC	82	3000	120	67 (2 lamp ballast)	8 (4-"2 lamp ballasts")	Luminaire: Lightolier 8097 Lamp: Philips Ballast: Compact SE 5%
FD5b	7" Dia. vertical lamp CF downlight w/ semi-specular reflector with white cone and fresnel lens, UL wet label	Recessed	1	CFTR32W/GX24q/830	ELECTRONIC	82	3000	120	36	6	Luminaire: Lightolier 8097 Lamp: Philips Ballast: Advance SmartMate
C3	Color-changing fiber optic underwater flat glass flood lens run from remote metal halide illuminator	In-pool	1	Fiber Optic	NA (Magnetic Transformer in base unit)	NA	NA	120	Total Fiber Optic System: 170 (3 used)	3	Luminaire: Supervision Lamp: MH in Illuminator Cable: PolyOptics Endlight Cable
C4	Color-changing fiber optic underwater convex glass flood lens run from remote metal halide illuminator	In-pool	1	Fiber Optic	NA (Magnetic Transformer in base unit)	NA	NA	120	(See Above)	2	Luminaire: Supervision Lamp: MH in Illuminator Cable: PolyOptics Endlight Cable
C5	Side light fiber optic cable for pool perimeter lighting	In-pool	1	Fiber Optic	NA (Magnetic Transformer in base unit)	NA	NA	120	(See Above)	1 (96ft)	Luminaire: PolyOptics Sidelight Lamp: MH in Illuminator Cable: PolyOptics Endlight Cable



FP4
Elliptipar –Pendant Uplight



FD5 & FD5b
Lightolier-Lensed Downlight

C3, C4, & C5
Supervision- In-pool Floodlights
PolyOptics-Sidelight Cable

Controls

RadioTouch Wireless Lighting Control by Lutron manages the lighting system of the pool. Within this system, various zones will be dimmable for user preference. An outline of the zones and dimming can be seen in the control description. A RadioTouch system works by sending radio frequency signals from a wall transmitter (or switch) to a controller of a lighting zone. A system controller is necessary for each of the lighting zones designated. Two wall transmitters are provided for, one at the main entrance to the pool and one at the service entrance door. These transmitters will allow occupants the ability to raise or lower any of the dimmable zones, turn luminaire groups on or off, and to select from four designated preset scenes. The system will also be integrated with a photocell to dim the lighting over the lap pool when sufficient light is available from the skylight above. The photocell is configured to control only the pendant fixtures along the sides of the lap pool.

Cross-reference to the 4.0 Construction Management Breadth can be made for additional information on Daylighting, Controls, and Energy Analysis.

Control	Control Description	Zone
R22 & 01HEA-	Pendants Above Lap Pool: Dimmable 10-100%	a
R22 & 01HEA-	Pendants Above Wading Pool/Jacuzzi: Dimmable 10-100%	b
R22 & 01HEA-	Downlights Along Side Seating Areas: Dimmable 10-100%	c
R22 & 01HEA-	Downlights Along Cove Seating Area: On/Off	d
R22	In-pool Lights: On/Off	e

1.6.7 Lighting Plans

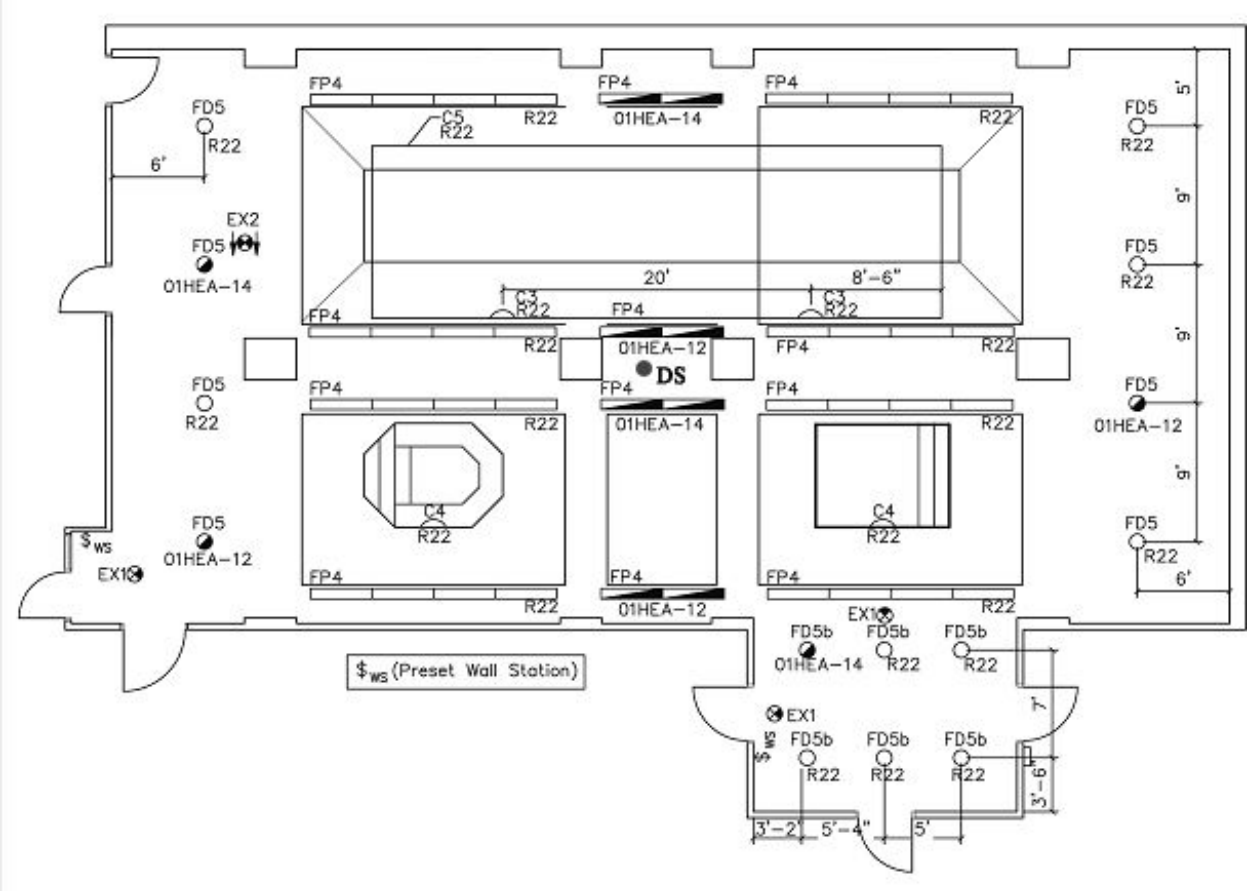


Figure 1.6.7a: Pool Lighting Plan With Fixture Designation, Dimensioning, and Circuiting

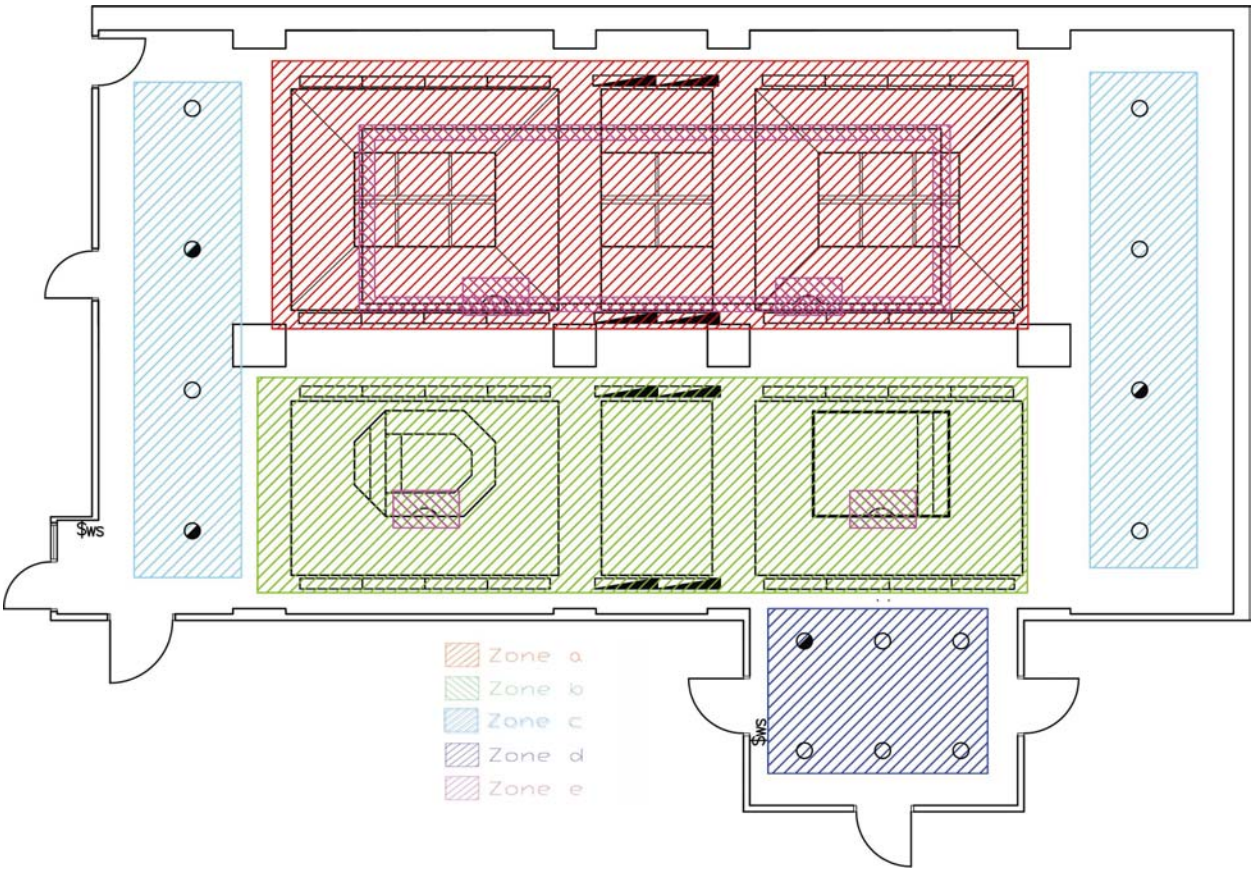


Figure 1.6.7b: Lighting Control Plan

Control	Control Description	Zone
R22 & 01HEA-	Pendants Above Lap Pool: Dimmable 10-100%	a
R22 & 01HEA-	Pendants Above Wading Pool/Jacuzzi: Dimmable 10-100%	b
R22 & 01HEA-	Downlights Along Side Seating Areas: Dimmable 10-100%	c
R22 & 01HEA-	Downlights Along Cove Seating Area: On/Off	d
R22	In-pool Lights: On/Off	e

Preset Control	Description	Zones
1	**Daylight Swim:** All downlights and pendants above wading pool area	b,c,d
2	**Night Swim:** In-pool lighting only	e
3	**Large Party:** Full On	a,b,c,d,e
4	**Lap Swimming Only:** In-pool lighting, Pendants above pool 100%, Downlights at 50%	e, a(100%), c(50%)

1.6.8 Circuiting

Luminaire	Watts	# ballasts used	VA Load
FP4	122	20	2440
FD5	67	4	268
FD5b	36	6	216
Lighting Load			2924
X Demand Factor (1.25)			
Total VA			3655

Underwater Luminaires			
Luminaire	Watts	# ballasts used	VA Load
C1,C2,C3	170	3	510
Lighting Load			510
X Demand Factor (1.25)			
Total VA			637.5

Circuit	Load (VA)	Wire Size	Breaker Size
R22	2812	12 AWG	20 A
01HEA-12	311	12 AWG	20 A
01HEA-14	311	12 AWG	20 A

1.6.9 Analysis

ASHRAE 90.1 Power Density

ASHRAE 90.1 Power Density Allowance: 1.1 W/sq.ft.

Design Watts: 2924 W
Total Room Area: 2933 sq.ft.
Power Density: 1.00 W/sq.ft

ASHRAE 90.1 Underwater Allowance: 1.0 W/sq.ft.

Design Watts: 510 W
Total Room Area: 528 sq.ft.
Power Density: 0.97 W/sq.ft

Satisfies ASHRAE 90.1 Power Density Requirements

Light Loss Factors

Luminaire Designation	Maintenance Category	Cleaning/ Atmosphere	Initial Lms/ Luminaire	Design Lms/ Luminaire	LLD	LDD	RSDD	Ballast Factor	Total LLF
FP4	VI	Medium-6 months	5000	4700	0.94	0.89	0.87	1.00	0.73
FD5	V	Medium-6 months	2400	1940	0.81	0.87	0.97	0.98	0.67
FD5b	V	Medium-6 months	2400	1940	0.81	0.87	0.97	0.98	0.67

Critical Design Performance

Critical design parameters are met by the pool lighting design. Figure 1.6.9a displays the illuminance values over the entire room at 3' above the floor. Lounge levels do, in fact, meet the illuminance criteria set forth. Although all values are not at 30 fc, areas not reaching this value are along the walls and are not believed critical. Additionally, illuminance values may be made lower due to the privatization of the pool, and the desire to create a very relaxed atmosphere. As these are the recorded values at 3' above the floor, it is comparable to say that values at the floor would read 10fc, another criteria suggested by the IESNA. The pool illuminance grid, Figure 1.6.9b, illustrates the uniform illuminance of 30 fc at the surface of the pool. This calculation is performed without any of the described in-pool lighting due to modeling circumstances.

Therefore, values may be thought slightly higher with the inclusion of the in-pool lighting. The uniformity of the pool is verified by the low coefficient of variance and uniformity gradient of 1 in the summary table. The wading pool and jacuzzi, meanwhile, possess higher illuminance values at 40 fc, Figure 1.6.9c. Vertical illuminance for facial rendering, Figure 1.6.9d, averages at 13 fc, a level that is quite satisfactory for a space that is non-critical for this purpose.

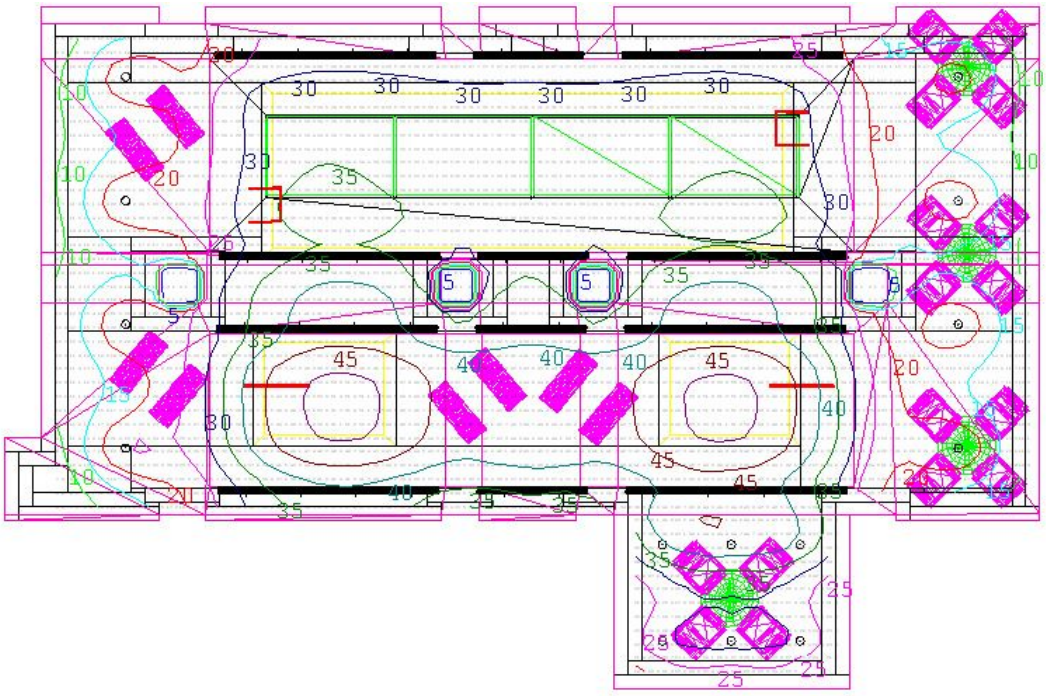


Figure 1.6.9a: Horizontal Illuminance at 3' Above the Floor

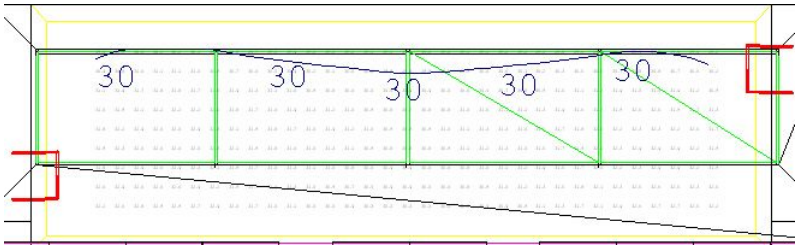


Figure 1.6.9b: Lap Pool Illuminance

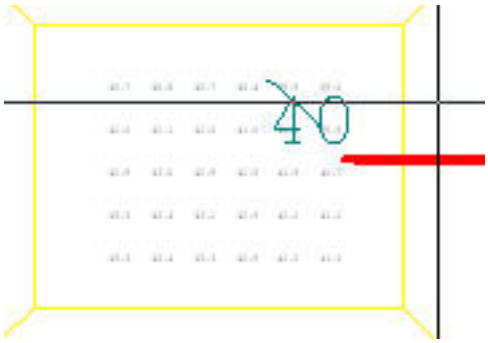


Figure 1.6.9c: Wading Pool Illuminance

Figure 1.6.9d: Vertical Facial Rendering Illuminance

Illuminance Value Summary (fc)				
	Work Plane	Ceiling Depression	Lap Pool	Wading Pool
Average	28.95	74.08	30.5	40.28
Maximum	48.5	108	32.2	41.6
Minimum	0.5	45.7	28.2	37.9
Avg/Min	57.9	1.62	1.08	1.06
Max/Min	97	2.36	1.14	1.1
Coeff. Of Var.	0.32	0.25	0.03	0.02
Unif. Gradiant	59.2	1.29	1.03	1.03
	Lounge #1	Lounge #2	Lounge #3	Faces: Seating Area
Average	16.4	16.79	30.97	13
Maximum	24.4	23.2	43.6	16.3
Minimum	0.5	10.8	21.6	9.6
Avg/Min	32.8	1.55	1.43	1.35
Max/Min	48.8	2.15	2.02	1.7
Coeff. Of Var.	0.28	0.17	0.18	0.09
Unif. Gradiant	34.6	1.3	1.15	1.04

1.6.10 Renderings

Figure 1.6.10a: Lap Pool

Figure 1.6.10b: Lap Pool

Figure 1.6.10c: Wading Pool

Figure 1.6.10d: Lounge Area

For images of the in-pool lighting, please refer to the Lighting Appendix at the end of this report.

1.6.11 Conclusions

As the analysis proves, the pool design is energy conscience, flexible, comfortable, maintainable, and aesthetically pleasing. Reflected glare, a major issue in pool spaces, is avoided while the most desirable form of light, daylight, is integrated into the system. All illuminance levels are maintained for safety, and yet, the user is given the ability to control his or her own surroundings. Additionally, by integrating in-pool luminaires, safety is improved while the pool's tranquility and appeal is enhanced.