Capital Improvements Plan - Recommendations for Camelback Mountain Resort

100% Deliverable

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Lafayette College EGRS 451 Capstone Group

Executive Summary

The following report is a detailed summary of the recommended capital improvement projects for Camelback Mountain Resort, located in Tannersville, Pennsylvania. Over the course of the 2011 spring semester, the Engineering Studies senior class completed extensive research into the existing problems at CMR, and analyzed numerous solutions in order to provide recommendations for the resort.

Broken down by system, this report outlines the scope of each project, the research completed to understand the existing problem, and the various alternatives considered. Extensive calculations were completed in an overall financial analysis in order to determine which solutions were optimal at CMR.

During visits to CMR, both staff and management expressed significant interest in strengthening the resort's commitment to the environment. To keep with this, students considered environmentally friendly equipment and materials whenever possible, and extensive research was completed on a 10 kW solar photovoltaic system, which would be placed on the roof of Cameltop Lodge.

Overall, this report provides insight and explanation to the various recommended capital improvement projects, which should be completed over the next five years. Solutions were chosen based on feasibility for the client, economic efficiency and overall sustainability.

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The Camelback Project

Introduction

Camelback Mountain Resort (CMR) is an outdoor complex comprised of a ski mountain, outdoor adventure course and water park. Open year round, this triple threat resort is dedicated to providing its customers with the best possible experience, no matter what season. Currently ranked as a leader in outdoor activities in the Pocono Mountain region, CMR provides more than 30 ski trails, 17 water attractions (not including the addition of two more this summer), and various outdoor activities including a zip line and tree top adventures course.

Purchased by the current owners approximately five years ago, much of the facility is in need of maintenance and/or replacement. Our goal in this report is to design a series of recommendations that will improve customer experience, as well strengthen Camelback's commitment to the environment.

Overall Scope of Work

Our report to CMR is divided into project areas that focus on various systems within the resort. CMR management has identified these systems as the most important and

pressing issues currently facing the resort. The project areas are: Building Capital Projects, Water and Restrooms, Food, Sustainability, and Information Technology (IT). Originally, the Heating, Ventilation and Air Conditioning (HVAC) system was also including in the scope, however, due to time constraints, the system was omitted from the final report. Within each area, this report will provide a detailed analysis, which will allow CMR to move forward with the implementation of our recommendations without requiring an additional allocation of resources to understand the current issues or research feasible alternatives. The depth of scope varies between each area and is based off specific recommendations from Camelback's Management.

Due to the magnitude of this project, and the limitations on time, this project focuses solely on capital improvement issues and does not include analyses or recommendations related to operations. In addition, the following areas have been excluded from the project: Snowmaking and On-Mountain Maintenance facilities, CamelBeach Waterpark facilities and Ski Lifts. Instead, resources have been concentrated on three facilities: Cameltop Lodge and the Main Lodge. Among these three structures the problems vary in complexity, significance and imminence, thus under each project area, solutions are proposed for a specific location rather than a generic alternative. It is important to note that recommendations for the Glenn Lodge are comprised of restroom and food service projects only.

The Final Report

Our report is composed of six sections, each focused around a specific system that the CMR staff identified as problematic. Each system was thoroughly researched in order to gain a basic understanding, prior to exploring any potential solutions. Various alternatives were considered, and solutions were compared based on economic efficiency and overall feasibility; environmental implications were also taken into consideration.

The following report represents the culmination of all the work completed throughout this semester. This report outlines the scope of work, details the method taken to address each of the systems, illustrates the alternatives considered, and explicitly delineates how the recommendations were chosen. A comprehensive financial analysis can be found in the final section of this report, while specific calculations for each alternative are listed in the respective sections.

Section 1: Building Capital Projects

Introduction

The goal of the building capital projects phase is to identify and propose accurate, feasible solutions for existing problems within various buildings at CMR. These problems will address maintenance issues related to foundations, building requirements, roofing, structural issues, and other general building issues. We provide an accurate assessment of what can be done to improve CMR's buildings and prioritize the relevance and necessity of these improvements. In addition we provide a five-year spending plan with contractor estimates and a prioritized list of projects relative to each project section's proposals.

Background

Leaky Roof at the Main Lodge

The Main Lodge has multiple issues with leaky roofs, including water damage on the interior roof, flooding problems in the basement, and convenience issues related to removing water effectively. We will eliminate the leaking issues with the current roofing by focusing on re-roofing solutions to provide better waterproofing and weatherproofing for both the interior roof and the basement areas of the Main Lodge.

Leaky Foundation at the Main Lodge

The leaky foundation in the Main Lodge basement affects electrical equipment, storage, and worker safety. We have identified multiple breaches in the concrete masonry unit walls and the foundation slab that leak water into the basement. We believe that this water buildup is mainly related to precipitation, and we have found a solution for foundation repair and waterproofing.

Deck Foundation at the Cameltop Lodge

The deck foundation at the Cameltop Lodge is currently a hazard to the structural integrity of the deck itself. We were told that the deck is not operational due to the safety risks that it presents, and upon inspection we identified column-related failures in the foundation. We provide a plan to renovate the deck into a usable state. This plan is tentative due to the alternative of constructing an entirely new Cameltop Lodge, but we leave that decision to the management of the resort.

Leaky Windows at the Cameltop Lodge

The windows at the Cameltop Lodge have been known to leak when it rains, and this presents a problem because of the number of large windows used in the lodge. We have investigated several options, and have compiled a plan to repair the windows and eliminate this issue. We came up with two alternatives that we see as the best way to fix the leaking problem. One requires complete demolition and replacement of all the windows and the other just the simple placement of waterproof caulk around the frames of the problem windows.

Scope

Leaky Roof at the Main Lodge

In order to provide viable options to repair the leaky roof on the Main Lodge, we first assessed the problem, and we decided that a new roof job should be done to alleviate the water damage to the interior of the lodge. We found that an ethylene propylene diene monomer (EPDM) roofing system, a material similar to rubber, was installed when the building was first constructed. This system is very useful for waterproofing but fails under strong sunlight, so we investigated possible alternatives. In order to counteract the high amounts of water permeation in the Main Lodge roof and resist thermal shock, we also considered polyvinyl chloride (PVC) shingles with an asphalt base as a roofing solution. Both of these methods involve fully adhering the material to the roof, so there are no gaps from nails or staples in the material that water can penetrate. It is possible to renew the EPDM roofing, which may have mixed results due to the weather conditions at Camelback, or choose the PVC shingles, which are suggested to be better at waterproofing as well as more durable in extreme temperature change. To weigh these options and propose the best solution to the leaky roof problem, we estimated the roof area, in square feet, from the site plans given, and we then used RS Means to estimate labor, material, overhead and profit costs for the two potential roofing jobs (Waier & Babbitt, 2009).

Leaky Foundation at the Main Lodge

To address the leaky foundation of the Main Lodge, we researched the different types of conditions that produce flooding issues in concrete masonry unit (CMU) foundation walls. We assumed that the flooding in the basement of the lodge is due to hydrostatic pressure from exterior ground water because the flooding issues were explained as most prevalent after periods of precipitation and large amounts of water coming in through bleed holes. This means that certain types of interior waterproofing would not be effective against this problem, such as exterior or interior EPDM waterproofing coatings. We found that a sump-pump installation, along the perimeter of the foundation or just

certain problem areas, would likely resolve the problem in the long term, and an epoxy resin spot treatment for bleed holes in the CMU walls would also be necessary to fully alleviate the problem.

We contacted two contractors for an estimate for an interior sump-pump solution based on the calculated perimeter of the foundation in linear feet, and we have used RS Means to estimate the cost of epoxy resin treatment for the bleed holes, using an estimate for number of holes as well, in terms of material, labor, overhead and profit costs per hole. We believe that an interior perimeter French drain system is the most economically viable solution to the leaky foundation in the basement of the Main Lodge. When compared to an interior EPDM damp proofing coating, the French drain system is more reliable because interior EPDM coatings are not meant to work against the type of water damage that the Main Lodge sustains. A French drain system is also more viable than an exterior EPDM coating because exterior EPDM coatings require excavation to install, and they are not as reliable when installed after construction. The French drain system solves the hydrostatic pressure problem, which is what is drawing water into the basement, and it also solves the bleed-hole issue with its wall treatment. The French drain system is also feasible because the sump pump components, which pump flood water to the exterior, are inside the building and can be accessed for further maintenance easily, and the process of installing the system is low risk, quick, and relatively cheap.

Deck Foundation at the Cameltop Lodge

We propose a renovation of the beam support structure while keeping the rest of the deck intact. Our preliminary investigation using the drawings given to us and RS Means indicated that demolishing and constructing a new 1500 square foot deck would cost several hundred thousand dollars (Waier & Babbitt, 2009). Furthermore, Diana told us that the problem was only with its foundation. Therefore, such a large investment is unnecessary in our opinion because the deck itself is still functional. We contacted a deck contractor to obtain an estimate for the repair of the foundation columns.

Leaky Windows at the Cameltop Lodge

During our building inspections of the Cameltop Lodge and conversations with CMR Staff, we noticed that many of the windows on the bottom floor were showing signs of leaking and water damage. We feel that the best solution is to replace the windows on the ground level and lower floors. The window replacement will improve the lodge's aesthetics and functionality because it allows Camelback to open the lower floor of the Cameltop Lodge, which also increases capacity. Alternatively, we also explored the possibility of caulking the existing window frames to try to control the leaking. This is a cheap solution that can have a variable amount of success, which depends on the undetermined location of the leaks. If the leaks are between the windows and the frame, caulk could help significantly, however if the leaks are between sliding portions of the windows, caulk may be ineffective. We have investigated both the cost of replacing the windows and the cost of caulking.

Results

Leaky Roof at the Main Lodge

Using Google Maps, we estimated the square footage of the roof for Camelback's Main Lodge see, Appendix A Figure A.1. Overall we found that the roof is approximately 42,000 square feet. This is a rough estimate that does not fully consider the perspective of the map and the pitch of the roof.

Once the total square feet of the roof was calculated (Appendix A, Table A.1), we used the RSMeans 2010 Construction Costs manual to estimate how much it would cost to replace the roof. We researched several different methods of typical roofing methods and found two ideal alternatives that we thinks are the best solutions to the leaking roof problems. Since both the PVC and the EPDM roofing solutions came in 100 square foot pieces we calculated that it would take about 420 pieces of material to cover the entire roof. Using the numbers given from RSMeans, we calculated the prices for materials,

labor, equipment and total both with and without overhead and profit, see Table 1.1 below. Since these numbers were in 2010 values we had to convert them into 2011 values using the interest formula with an annual interest rate of 1.24%.

Table 1.1. RSMeans cost estimates for alternatives (Waier & Babbitt, 2009)

Roof Type	Materials	Labor	Equipment	Total	Total inc. O&P
EPDM	$44,000	$21,000	$3,000	$68,000	$86,000
PVC	$50,000	$21,000	$3,000	$74,000	$93,000

Leaky Foundation at the Main Lodge

Using the ruler tool on Adobe Acrobat, we estimated, using the floor plans provided the perimeter of the existing basement to be 107 linear feet. We then contacted two different foundation waterproofing contractors for rough estimates to fix the flooding throughout the basement in the main lodge. We contacted Century Waterproofing out of Sussex, NJ and they gave us an estimate of $7,500 for the solutions listed in the previous section. We also contacted B-Dry System Inc. and they gave us an estimate of $11,000 for the solutions that we listed above. For our actual estimate we averaged the estimated that we received from the contractors to find an estimate of the instillation cost along with overhead and profit. We estimate that a French drain system will cost $9,250. Overall this is a high priority solution considering the amount of flooding that occurs throughout the year, and the impact that it has on the employees at Camelback.

Deck Foundation at the Cameltop Lodge

According to Blakeslee Home Improvement Inc., replacing each column of the two-tier deck would cost between $200 and $300 depending on the location and the slope of the land. Due to Cameltop's mountain location and to the sloped nature of the terrain, the cost would be closer to $300 due to the increased difficulty of the operations and

transport of materials. The existing deck would need to be jacked up to provide for temporary support in order to install the new reinforced concrete columns, which would be buried 42 inches into the ground. The total cost of the project would be approximately $4,500. We have estimated the number of columns to be about 15.

Leaky Windows at the Cameltop Lodge

Using the layouts that were provided by Cameltop, we estimated the areas and linear footage of the windows on both floors. We calculated that there were 32 large windows, each measuring 4'x7', and 8 smaller windows measuring 4'x6'. The combined area of the windows was calculated to be 1088 square feet. Using these numbers we calculated three different alternatives to repair the leaky windows. Our first alternative is to demolish all of windows that are currently in place. This alternative would cost approximately $588 for labor and the total cost including overhead and profit would be $900. All of these prices were found using RSS Means. The second alternative is a complete window replacement. The cost of this alternative would be $1660 for labor costs and $18,400 for materials. The total cost including overhead and profit would be $23,000, but this alternative would also require the demolition of the current window system. The price for the demolition and replacement would be $23,900, also according to RS Means. The final alternative would be to fix the leaking of the windows by using caulk as a waterproofing agent. For this alternative we calculated the total linear feet of the windows to be 52 feet and found that 1 tube of caulk, which is 10.3 oz, can caulk up to 4 feet. From this we calculated that 13 bottles of caulk would be needed. From Home Depot, we found that 13 bottles of caulk would cost $111.58. We estimated that the labor would take 8 hours, at a cost of $15 an hour, which resulted in a total labor cost of $120. We estimate that it would cost $231.00 for this alternative to be completed successfully.

Table 1.2. Window Alternative Costs at the Cameltop Lodge

Alternatives	Labor	Materials	Total	Total w/ O&P
Window-Only Demolition	588	--	588	900
Window Replacement	1660	18400	20060	2300
Total (Demolition & Replacement)	2248	18400	20648	23900
Caulking	120	111	231	--

Section 2: Water/Restrooms

Introduction

Water quality and restroom facilities are urgent concerns for CMR. The main areas of concern include: the damaging effects of hard water and unpleasant bathroom aesthetics. Throughout the years, visitors have given the bathrooms an overall negative rating; complaints about the smell, a dirty appearance, and toilets that do not flush. Due to the lack of sufficient ventilation and the residue and water left behind by visitors, bathrooms face high wear and tear, and often appear dirty despite repeated cleanings. This section compares different options for fixing each of these issues and incorporates the recommended solutions into Camelback's five-year plan for water and restroom renovation.

Background

The conditions mentioned above are of major concern to the CMR staff, and also detract from the overall customer experience at the resort. The high mineral contents of Calcium and magnesium ions in the water severely damage the utilities and often leave stains on the toilets, which create a filthy appearance. The buildup of minerals also impacts various pieces of kitchen equipment, often causing malfunctions or complete shut downs of

important appliances. The hard water, specifically, has caused toilets, sinks, urinals, etc. to malfunction and gain a buildup of residue.

Scope

Research has been conducted to provide information on possible water treatment alternatives ranging from water softeners to water additives. Different technologies and different makes and models were compared based on their cost and effectiveness in combating the problems caused by hard water at Camelback. In order to get rid of the smell that is present within the restrooms different types of ventilation units were considered and a recommendation was chosen based on the same qualities as the hard water solution. The best method of getting rid of the bad appearance caused by the puddles of water on the floors was to cover up the puddles with permeable floor mats. In a later section a mat that would perform this function is proposed for use.

Results

Water Conditioners

The most economical and effective solution to the existing hard water problems at Camelback is an electronic water conditioner (see Figure 2.1). A water conditioner uses electronic signal wires wrapped around a copper, PVC or PEX pipe to send electronic frequencies (not actual electricity) through the pipe resulting in molecular agitation (Easy Water). It is relatively compact, inexpensive, requires low maintenance and is considered sustainable (Easy Water). The water conditioner facilitates water flow by using specific frequencies that readjust the formation of the minerals such as the magnesium, and calcium in the water from elongated branches to disks (Faraday's Law), causing them to lose their electrostatic property and ability to stick to surfaces (Easy Water). The water conditioning process only addresses the water hardness. There is no effect on the taste or smell of the water, since it does not add or remove any mineral content.

This water conditioning process has many benefits for its users. First of all, the system is small (usually the size of a textbook) and inexpensive ($1,000 to $3,000 range). Each unit is easily installed by screwing a unit into a wall near each feeder pipe and a wire is wrapped around the feeder pipe. This could be performed by the maintenance staff at Camelback without causing any significant increase in the staff's load of work. In addition these systems require little to no maintenance, consume very little electricity ($10 to $50 per unit per year), and have no parts or materials that must be replaced or replenished periodically. This makes this type of system and its installation a very economical choice for Camelback. These water conditioning systems are a little known, newer technology, but they have been proven in the worldwide market. Many of the water conditioning companies have international and highly recognized clients that use their systems in commercial settings.

Figure 2.1: Scalewatcher Commercial water conditioner (Scalewatcher)

The product that best fits Camelback's needs is the Scalewatcher Commercial (CM model line) of water conditioners (Figure 2.1). This line of models has specific models for many different pipe sizes, which makes them very easy to apply to any water system (Scalewatcher). What also makes these models easily applied is the fact that they are designed for a specific diameter of pipe rather than water pressure and flow, which can vary within such a large water pipe system as the one at Camelback. The Scalewatcher Company has proven itself on the worldwide market with a number of large and established customers, such as Guinness Brewing and Hilton Hotels, and it has an A+ rating from the Better Business Bureau (Scalewatcher). This is proof enough that these

water conditioners have been successfully implemented within commercial settings and that the customers of the Scalewatcher company have been thoroughly satisfied. The CM models use very little electricity (less than 100mA, 110 V) (Scalewatcher). They also maintain the small dimensions of 6.3”x3.9”x2.5” (Scalewatcher). They are competitively priced against other water conditioners at $999 for the 2 inch diameter pipe model and $1899 for the 4 inch diameter pipe model (Scalewatcher). For all of these reasons, the Scalewatcher Commercial CM line is the most appropriate solution to the problems that hard water causes at the Camelback Resort.

Because the Scalewatcher water conditioners are designed for specific maximum pipe diameters it is easy to select the correct model to be placed at each feeder pipe within the Camelback water supply system. The water study that was supplied by Camelback included the diameters for all of the feeder pipes for the different buildings. All of them were either 2 or 3 inches in diameter. So, if Camelback chooses to go with this option, CM2 models designed for 2 inch diameter pipes would be placed on the 2 inch diameter feeder pipes. CM4 models designed for 4 inch diameter pipes would be placed on the three inch diameter pipes because there is no model designed specifically for 3 inch diameter pipes. No further study would be needed to select a system or unit to treat the water at Camelback.

Other viable options in the market are the Natursoft Salt-free water conditioner manufactured by Pelican Water Technologies, and the EasyWater 3000 from Easy Water. The Pelican NaturSoft Salt-Free water conditioner is able to handle a maximum water consumption of six residential-use bathrooms, and has received the Water Quality Association’s Gold Seal Certification (Pelican). It is priced at $1,545 but does not have the same capacity as the CM conditioners; to make up for this multiple units can be installed on a single pipe (Pelican). Another option is the Easy Water 3500, priced at $1,979, which has a 2 ½ inch pipe diameter capacity (Easy Water). Though it has been

used in commercial settings, often many units are required to effectively condition all the water (Easy Water).

Other Applicable Technologies

In case a water conditioner is for some reason not what the staff at Camelback wants, these are some other technologies that can be used to combat hard water. The most well known option for treating hard water is a salt water softening system. This would replace the calcium and magnesium in the water with sodium chloride.

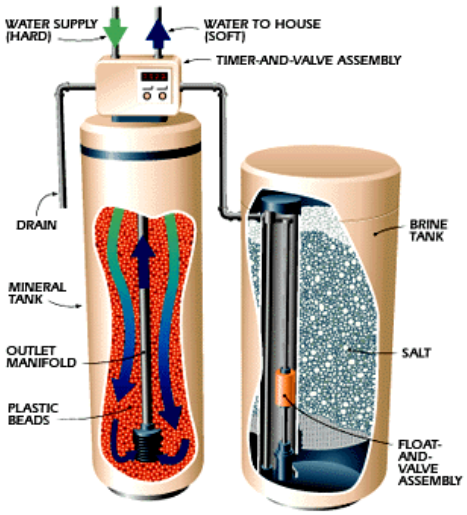


Figure 2.2: Traditional Salt Water Softener (Water Softeners)

The next option is to use a traditional salt water softener system but substitute potassium chloride for sodium chloride. This would be a viable option if Camelback already had a salt water softening system in place; however, to the best of our knowledge, that is not the case. The potassium would replace the magnesium and calcium in the water, thus leading to high concentrations of potassium in the water source. As Americans typically do not get enough potassium in their diets (and far too much sodium), the most relevant use for this technology is in a home with children or by a company where the taste of the water is a main factor. Since this system is based off the salt water softener, the cost and necessary maintenance of this system also does not seem to fit the needs of Camelback.

Another option is to use reverse osmosis to remove all minerals from the water. This process separates dissolved ions, heavy molecular weight compounds, and particulate matter from the liquid stream of water as it passes through multiple membranes. Since this technology requires a specific water pressure, temperature, flow rate, etc. the system as a whole is a more expensive alternative. There is also required maintenance and monitoring of the system; pressure and flow values must be noted so they do not deviate from the normal values, as well as periodic cleaning of the membrane, changing of the prefilter cartridge, and mixing and adding chemicals. This option is very popular in California; however, the maintenance and high use of electricity to run the system, when added to the initial cost, does not seem plausible for the needs of our client.

Although these other technologies are both very effective methods for getting rid of hard water and the problems that it causes they have very large shortcomings when compared to the water conditioners. Both of these technologies would incur a much larger up front and annual cost for Camelback and are much more complicated systems. The reverse osmosis system would use a huge amount of electricity, and the salt water softener would require large amounts of salt to be purchased each year to allow the softener to perform its function. In addition the complexity of both of these technologies could call for large changes to the water system itself to provide the correct flow and pressure through the equipment. These much larger pieces of equipment would also require a more complicated and costly installation. These are the reasons these technologies were not recommended as the solution that Camelback should use.

Ventilation

Good ventilation of the bathrooms should be achieved through the utilization of an exhaust system that is capable of neutralizing odors— an Energy Recovery Ventilator (ERV) is best suited for this task. ERV systems are designed to reduce energy consumption and improve Indoor Air Quality (IAQ) by capturing and recycling building energy to humidify, pre-cool or dehumidify incoming air. ERV systems recover approximately 70%-80% of the energy in the exiting air and deliver that energy to the

incoming air; most cost effective in climates with extreme winters or summers and where fuel costs are high (Energy Savers).

Three companies, which produce ERV systems, have been identified as currently producers of the best systems in the market—Mistubishi Electric, Panasonic and RenewAire. Mistubishi manufactures Lossnay ERV, which provides outdoor air solutions to improve indoor environmental quality; Panasonic manufactures WhisperGreen, a ceiling mounted continuous- and spot-ventilation fan with a SmartAction Motion Sensor and Light; RenewAire also manufactures a ceiling mounted fan. The recommended manufacture is RenewAire because they provide a range of ERV models, from a single ceiling unit to indoor and outdoor central units. See Appendix B for details.

The costs of the ERV units vary because of their different functions and usages. The Lossnay is the most expensive with prices ranging from $2,200.00 to $3,200.00 (See table B.2). This is because this commercially orientated system can be utilised virtually anywhere to extract stale air and then recover the heating or cooling energy to either warm or cool incoming fresh air (Orion air sales). The Lossnay, more suitable for commercial use allows for larger duct sizing. The nominal duct diameters offered by the lossnay range from 8in. to 14in. The Panasonic WhisperGreen ventilations and the RenewAire V-Series are not as expensive as the Lossnay. The WhisperGreen, which is more expensive than the V-series, has a price range from $240.00 to $350.00. It allows for nominal duct diameters of 4in and 6in (See table B.1). The V-Series products have retail costs ranging from $140.00 to $200.00 for unit, with a duct diameter of 4in and 6in as well (See table B.3).

Figure 2.3: Mitsubishi Lossnay, Panasonic Whisper Green and RenewAire Vseries (Mitsubishi Electric & Electronics, Panasonic, RenewAire)

Floor Mats

Water build up on the floors in the restrooms can be solved by the addition of floor matting. These mats will allow for water to filter through them and run off from ski boots to enter into the drains. They will also provide a non-slippery cushion for the customers and employees to stand upon. Proper drainage combined with the proposed ventilation system will create cleaner air and a safer environment.

Alternatives for matting include fine and wide ribbed, corrugated rubber mats. Water will flow in between the ribs, keeping it off the floor and also away from the customers and employees. However, these models are made to be water impermeable and are less likely to allow for easy water flow into a drain.

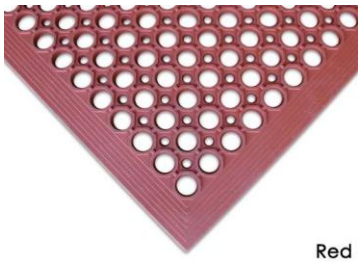


Figure 2.4: Dura-Chef ½" thick Mat (Floor Mat Company)

Another type of mat that best fits Camelbacks needs is the Dura-Chef Model (Figure 3.4). This product has circular holes that allow for water to fall through, effectively keeping the walking surface dry. The water will flow through the mat into the drain underneath. They can be purchased in thickness that ranges from a half inch to 7/8th inch. Created from eco-conscious natural rubber, these mats come in multiple colors and are easy to clean. Quotes for this product be made online; they state it will be around $36 per unit if 100 plus units are purchased (Rubber Floor Mats).

Water Usage

It is important to consider lowering the amount of water used in each restroom; this will aid in reducing system backup, the need for cleaning, and save Camelback money. Products such as low-flow toilets and sinks and dry urinals are great solutions. Water usage in restrooms at Camelback would be reduced with the use of high efficiency urinals, toilets, and sinks (see Figures B.1, B.2 and B.3 respectively for a list of water and financial savings).

Low-Flow Fixtures - Background

Various bathroom facilities at the site are currently in need of renovation. These renovations have the potential to replace the existing fixtures with newer, low-flow ones that will minimize water usage while maintaining a high standard of cleanliness. Research was conducted to analyze, and recommended the most feasible options for bathroom fixtures (toilets and urinals) that also operate with efficiency in mind. Recommendations considered optimal flow rates that will balance efficiency with the

demand for capacity, ADA requirements, price, aesthetics, and hygiene. It is important to note some of the existing urinals and toilets may be acceptable for the time being, especially any newly replaced ones with automatic flushers. If they have a life of a more than 10 years left in them, we recommend that they be kept. However, this would require a case by case inspection of the bathrooms and fixtures. If they are outdated and call for replacing within the next five years, we recommend a very sustainable, low-flow toilet. It is our ultimate goal to replace all the toilets with a uniform brand and style per the suggestions made by CMR. Maintaining a uniform style of fixtures will also enhance the ascetic appeal of the bathrooms and in turn the perception the customer has of the cleanliness of the bathroom, therefore the overall satisfaction of the customer experience. Total numbers of toilets and urinals under investigation were supplied by CMR. Calculations were derived from this information given several assumptions made due to a lack of detailed bathroom use information.

Low-Flow Bathroom Fixtures

From the guidelines laid forth in the scope, various options for low-flow toilets and urinals as well as waterless units were considered. Based on the research conducted into low-flow toilets and urinals as well as waterless urinals, Tables B.4 and B.5 in Appendix B set out available options that we recommend as feasible alternatives. Appendix D, Tables D.5 and D.6, highlight the toilet and urinal options that the Sustainability Section proposes to be the best alternatives based on efficiency and price point. These tables present a variety of options for toilets that are all below 1.6 GPF flow rates; urinals are all 0.5 or less GPF, and sinks that use less than 1.6 Gallons of water per minute (GPM). Final choice on toilet models are ultimately in the hands of CMR based on what they feel would be the most economic and environmentally friendly selection.

Restroom information was received from CMR, focusing on the Pennsylvania Room, Ski Repair, Security, and Coolmoor bathrooms. These facilities encompass 83 toilets (30% of total toilets) and 29 urinals, and 50 sinks. Approximate calculations were performed, making the following assumptions: CMR receives about 700,000 patrons annually using

bathroom facilities, each toilet or urinal is flushed 7 times daily, with water at a cost of $6.06/1,000gal. CMR provided us with data showing 83 toilets; 74 are 1.6 GPF units, and 9 are 1.3 GPF units. If low flow toilets that are 1.28 GPF replaced these toilets, this would result in a savings of about $370 per year (Full calculations provided in Figure B.2). Calculations for savings in water and cost per year for urinals and sinks can also be found in Figures B.1 and B.3 respectively.

Restroom Appearance

There are many aspects of the restroom that need to be identified in order to improve its overall appearance. Some of them are: walls, lighting, ceiling, counters, and bathroom stalls. The wall is one of the most important aspects of the bathroom for aesthetics purposes. It is recommended that the walls are repainted, cleaned, and tiles are replaced. Also bright paint or brighter material for the wall would better improve the aesthetics of the wall. Interior semi-gloss would be a great choice for the bathroom paint because it is very resistant to mildew and makes routine cleaning a lot easier. This type of paint on average costs around $34 per gallon at Lowe's (Lowes). Cheaper ones at $15 per gallon can be found at The Home Depot but these take a lot longer to dry (Home Depot). Cost for wall tiles range from $1.98/Sq. Ft. - $14.99/Sq. Ft (Wall Tiles). In order to brighten up the bathroom, LED lights or new fluorescent light assemblies should be installed. LED lights are beneficial because apart from the fact that they last a lot longer than other lights, they save a lot of energy. Fluorescent lights are a lot brighter than most other lights and also are a lot cheaper than most other lights. If fluorescent light is used, it shouldn't be the typical ceiling tile installation because that tends to collect dirt, bugs, and stains. The ceiling should be replaced with either new ceiling tiles or it should be painted just like the wall if kept plain. The counters should be replaced with a false granite pattern that exposes dirt and allows less staining. This will make it easier to clean and maintain. Lowe's sells granite sheet laminates for $52, (30" x 120") (Lowes).

New bathroom stalls, sinks, toilets, urinals, hand driers and soap dispensers should be implemented. State of the art sinks, toilets, urinals, hand driers, and soap dispensers are suggested. This means everything is hands free. It allows for less transfer of germs and viruses. Less expensive hands free faucets cost around $300 but can easily range up to $1000 (Sams Club). An automatic flush valve on average costs around $200 and can be installed with any toilet and urinal (Sams Club). A touch free foam dispenser cost from $10 – $60+ (Sams Club). Touch free paper towel dispensers can cost from $20 - $100+ (Sams Club) and the energy efficient hand dryers range from $375 - $500 (EXT Series). A combination of the two would probably serve best since it would allow for fewer lines when drying hands. Stainless steel stalls should be installed because they show less dirt, are not scratched as easily as paint, won't corrode, and won't stain like paint. A three standard stainless steel stall can cost around $2,735.56 (3 Std).

Section 3: Food Service

Introduction

An analysis of the existing conditions in the three kitchens at Camelback was completed in order to prioritize various repairs and upgrades. These priorities were analyzed and ranked based upon the concerns expressed by Camelback management during our multiple site evaluations. The recommended alterations range from simple equipment upgrades to major capital projects, such as the installation of a service elevator in the Main Lodge.

Background

The recommended modifications for various kitchen appliances would eliminate the existing code violations and improve overall performance. An in depth field evaluation was completed to analyze the layout and equipment inventory of each kitchen. This allowed for the development of applicable, feasible solutions. Based on this evaluation, four main components that should be addressed were identified: 1) the installation of a service elevator, 2) the issues associated with a hard water supply, 3) the installation of drainage systems, and 4) overdue equipment maintenance and upgrades. Solutions were compared based on cost, efficiency and feasibility, along with overall sustainability.

Besides focusing on easing kitchen operations through the repair and replacement of outdated equipment, management was adamant about finding ways to improve customer experience, specifically through a more interactive experience in the dining halls.

Scope

The owners, in collaboration with the Vice Presidents of Camelback, have expressed their willingness to accept slightly higher costs if solutions were sustainable and eco-friendly; this information was an important consideration when weighing the potential upgrade options. For example, the recommended service elevator has a slightly higher cost, but is a renowned model due to its high level of sustainability. Camelback management requested the installation of a service elevator, since food is currently transported, by hand, across several landings, throughout the Main Lodge. This requests illustrates the dedication CMR management has to implementing changes to help their employees.

Currently, CMR's water supply derives from various onsite wells, which poses the problem of hard water. This water, abundant in minerals, has caused significant damage to the kitchen equipment, and also creates an undesired reddish color in the toilet water. Guests interpret this discoloring as unsanitary, and have reflected this in their subjective evaluations. This issue is addressed further in Section 2: Water/Restroom. When making decisions regarding kitchen equipment repairs and replacements, hard water will pose additional problems, unless a filtering system is installed to prevent erosion.

Since the exact year of each individual piece of equipment is unknown, the assumption was made that the equipment is at least five years old. Based on analysis, the recommended approach to equipment upgrades is by kitchen; this would allow construction to be isolated to one location at a time. Existing equipment condition is the second factor recommended in the prioritization of repairs and replacements. In order to provide recommendations, the current equipment was assumed to be at least five years old. This assumption is based on the fact that minimal repairs or replacements have been

completed since Camelback was purchase by the current owners approximately 4 years ago.

There are minimal limitations to the recommendations. A possible limitation may involve any Pennsylvania laws regarding the maintenance and use of an elevator. The only concern regarding the kitchen equipment upgrades is keeping in line with code violations.

Service Elevator

Existing product transportation difficulties in the Main Lodge of CMR will be alleviated with the KONE TranSys freight elevator designed for handling goods and materials in 2-to-6-floor buildings. It is a "machine room-less" (MRL) elevator meaning there is no control room; instead the box is attached, via a permanent magnet, to the outside of the machine. All of the components of the elevator are confined to one shaft, simplifying building interface. This elevator is the leading choice in the MRL category.

Installation and Maintenance

MRL elevators have a lower market price for purchase and installation in comparison to hydraulic elevators. The purchase and installation, shaft included, has a cost estimate of $85,000 (KONE Corporation, Harrisburg Office). It will take approximately 26 weeks from the placement of the order to be delivered. The time span for installation is dependent on the number of landings being accommodated. Since Camelback is only accommodating two landings, it should take about 2 weeks to complete installation (KONE Corporation, Harrisburg Office). KONE explains that the roof and lift shaft must be 100% completed before the elevator is brought in. The lift is installed through the bottom floor and is built in situ.

All elevators have required maintenance by law. The frequency of maintenance is often based on the usage levels or via a calendar basis; making it convenient for you to define an individualized regimen. This annual maintenance cost would only consist of

insurance, which we do not have enough information to determine, as well as PA state inspection fees.

Specifications

The MRL elevator has a capacity of 1000-5000kg/person with a maximum group size of 4 persons. It travels at speeds ranging from 0.5-1.6 m/s with maximum travel from 23-to-40 meters. This fast and durable elevator offers full width doors to maximize the car use. There are also many customization options with KONE elevators, since they offer an array of ceiling, wall, railing, and control panel options. Even though this is a service elevator, it is certainly customer friendly.

Shaft Construction

KONE states that the shaft can be constructed with any material that can withstand the loads, opening up a window of options for sustainability purposes. Shafts they have previously built were constructed from in situ concrete, prefabricated concrete, and core filled reinforced concrete blocks. For the Camelback installation, prefabricated (pre-cast) concrete would most likely not be used since the building is already constructed; either in situ concrete or core-filled reinforced concrete would be used, both of which are low in cost.

Sustainability

KONE is a national member of the USGBC, and was the first to develop the MRL elevator that uses no oil and less energy making it one of the most environmentally sound elevator concepts in the industry (KONE Corp). The elevator (not the shaft) is made of 95% recyclable materials, its efficiency is approximately three times that of a hydraulic run elevator, and uses an estimated 70% less energy.

LEED

Table 3.1, provided by KONE, explains the effects the installation of the KONE sustainable elevator will have when it comes to achieving LEED accreditation. Table 3.1 refers to the LEED requirements for operations and maintenance of existing building.

Table 3.1: LEED-EB O&M 2009: Taken from KONE LEED contribution fact sheet (KONE, 2009)

Category	Credit	Description	KONE Contribution
Energy and Atmosphere	EAp1	Minimize Energy Efficiency Performance	Elevators and Escalators account for 2-10% of a total building's energy use
Energy and Atmosphere	EAc1	Optimize Energy Performance	Elevators and escalators account For 2-10% of a total building's energy use
Indoor Environmental Quality	IEQc2.1	Occupant Comfort	KONE's MRL elevator technology has decreased noise levels
Innovation in Operations	IO	Innovations in Operations	Contact sales rep for IO submittal assistance

Drainage

As part of the recommended renovation plan for the Camelback kitchens, the installation of a new drainage system was considered. The need for a new drainage system derives from the safety hazards surrounding the current system. The lack of floor drains has caused the tile flooring to become extremely slippery, which creates potential danger for the employees. To be most effective these drains should be installed with a concave shape surrounding each drain location. This shape would involve angling concrete toward the drain when its poured and then layered with tile.

The use of recycled tire mats would also be a sustainable solution that would add extra protection against slippery floors. To limit costs, these mats could have placement limitations for areas of heavy traffic or areas near sinks. The Dura Chef 7/8" drainage

mat would be the ideal choice; it is sustainable, durable, and customizable to fit any space. The holes are large enough to let even liquids as thick as grease through. The thickness, providing extreme comfort, will also ease the labor of the employees - a main goal expressed by Camelback management. These mats are lightweight and easy to maintain; Table C.1 shows the various cost options.

Based off of the most recent floor plans, the Base Lodge Kitchen dimensions were approximated at 28x15 feet. To cover this area, it will require 24 tiles. However, taking into account the floor space occupied by various kitchen appliances, only approximately 20 tiles are required, which cost around $1,500.

Appliance Upgrades

Many kitchen appliances currently installed at Camelback have been exhausted and need replacement. Five years was assumed because the resort changed owners approximately five years ago, and few upgrades have been completed since.

Walk in Freezers

The freezers are used with a high frequency in every kitchen at Camelback. Since the freezers are responsible for keeps food fresh for the customers, it is important that they are functioning to the best of their ability. The walk-in freezers in the kitchens of Camelback will need to be replaced within the next five years.

The current walks in freezers are all Bohn LET0901F. The recommendation is to replace these freezers with new, energy efficient models, such as the U.S Cooler Model FR710510FL.D, a sustainable, walk-in freezer with a floor. The dimensions of this item are 5’ 10.5” x 7’ 10” x 7’ 6” and it costs $3,700 (DM International Equipment Corp). For a freezer of this size, this model is much more efficient, mostly since it is made of extruded polystyrene, rather than the typical material, polyurethane. This freezer will produce energy savings of about $2,700 over the course of just five years (US Cooler

Company) per freezer. Important to note, however, that it may incur maintenance costs of around $2,700 per year (US Cooler Company). There is no difference in the efficiency if the freezers are replaced all at once or one at a time.

A second alternative to the existing freezers is the U.S. Cooler is the Arctic WB0621023. It is a 6' x 6' walk-in freezer with a floor made of Energy Code compliant hi-density foam and has an initial cost of $6,800 (US Cooler Company). Both the interior and exteriors are made of Acrylume finish that minimizes fingerprints and oxidation. This freezer is created on a modular design that makes installation easy. The spring door closure and magnetic gaskets ensure an air tight seal that will help Camelback save money on electricity, but not as much as the resort would save if they invested in the polystyrene freezer.

Appliances

With the same assumptions, the remaining appliances, including stoves, ovens, fryers, and refrigerators, are a minimum of five years old and have a life span of ten years. We recommend upgrading and replacing this equipment within the next five years, preferably prior to any malfunction. Through a field evaluation an inventory has been completed, which is listed in the appendix, and has broken it down between the three kitchens of the Main Lodge. The cost and savings for each individual kitchen can be seen in the Section 6: Finance. Any appliance that is seldom used or currently out of commission was not included in the comprehensive inventory. All estimates come from Energy Star appliances since they are affordably sustainable.

Section 4: Sustainability

Introduction

As part of the capital budget project at CMR Mountain Resort project, the sustainability of all upgrades and improvements need to be evaluated. Additionally, the feasibility of possible renewable energy enhancements have been examined. The sustainable options investigated herein are not only measured by environmental means, but also with respect to financial and social responsibility. This sustainability study worked in concert other aspects of the project to explore and recommend upgrades, repairs, and replacements.

Background

CMR's current and future facilities are the potential host to several renewable energy options. Sustainable developments offer not only financial savings in the long term, but also lessen the impact of business operations on the environment. By implementing these improvements, CMR can improve its image in the eyes of the conscious consumer, making it a more desirable recreation destination. CMR also has the opportunity to update water fixtures in lavatories, implement a renewable energy program in the form of rooftop solar panels, and install kitchen drainage options that optimize sustainability.

Scope

We have focused on evaluating and recommending options for maintenance and upgrades that will best suit the needs of the ski resort. Work concerning low-flow toilets and urinals is located in the Water section to avoid redundancy. This capital budget plan seeks to integrate the most sustainable projects in each of the areas of concern, including the following:

Renewable Energy/Sustainability Incentives

Taking into mind any and all improvements which may be made, federal, state, and local sustainability incentives have been thoroughly researched. These include grants, loans, tax credits and deductions, and rebates. Assistance programs are available for large scale improvements such as the installation of wind turbines, solar panels, and geothermal. Also, smaller upgrades such as lighting and higher efficiency equipment can be funded by these incentives.

Cameltop Improvements

We researched the feasibility of various renewable energy options for this facility. We examined the practicality of solar panels at this site. The building also has potential for smaller upgrades including lighting, insulation, and appliances. Recommendations accounted for the existing building as well as the construction of a new Cameltop facility. Both outlooks factored into the decisions made about Cameltop.

Kitchen Drain Materials

It is understood that drainage in kitchens and food preparation areas needs to be improved. While drainage measurements are described in the Food Services and Water section, we describe the most suitable materials for the drains in this section. We ensure that the material composition of the drains will withstand a range of fluid conditions. The determination of an appropriate material also depends on the locations of the drains. To

accomplish this task, floor plans of the kitchen were examined. Assumptions were made concerning volumes and materials being put into drains based on the typical wastes of restaurants and kitchens, including water and grease, not exceeding 212ºF.

Results

Available Incentives

Data regarding sustainability and renewable energy incentives has been researched. This information has been gathered from the Database of State Incentives for Renewables & Efficiency (DSIRE). Programs from federal, state, and Pennsylvania Power and Light can be found in Tables D.1 through D.3, of Appendix D. Several compatible sustainable energy incentives exist that CMR may be able to take advantage of for the renovation of existing facilities or construction of renewable energy sources of which, tax-paying entities are eligible. Of the programs listed, it should be noted that most do not allow piggybacking of similar grants or credits. While available federal programs require a larger commitment to the development of renewables, state and PP&L programs offer grants and rebates that are more appropriate for smaller sustainable improvements.

Cameltop Improvements

This work focused on sustainability options for Cameltop both for the existing structure as well as a new construction. Preliminary indications favored the installation of rooftop solar panels on the building given its prominent mountaintop position.

Rough preliminary calculations based on aerial photography (Appendix D, Figure D.1) indicate an area of approximately 2,268 SF on the north-facing roof and 2,772 SF on the south-facing roof, totaling 5,040 SF. These were compared with plans of CamelTop. It should be noted that southern-facing roofs are optimal for solar panels (Landau, 2011). Panels are generally estimated to produce 8 – 10 watts per square foot (Energy Matters, 2011). This put the possible capacity of 40kW for a rooftop installation at CamelTop. In

the case that a new facility is built, it is recommended that the building have an entirely south-facing slanted roof to maximize the capture of solar radiation.

The PV option was also analyzed financially. Being considered is an 88 panel, 21.120 kW Phono Solar system package using high efficiency 240 watt Monocrystalline panels. Monocrystalline performs better in low light conditions which maximizes system output (Harrington, 2011). This system has a unit cost of $69,000 with an additional $20,000 - $30,000 for installation, totaling $100,000 to be paid at the time of purchase. If the Business Energy Investment Tax Credit (ITC) is applied, this can cut capital costs 30%, down to approximately $70,000. Operating and maintenance costs are liberally estimated to be $250 per year due to extra snow removal, or about $2,000 over the life of the system for semi-annual cleaning and repairs as provided by the manufacturer (Harrington, 2011). This number has been inflated three-fold to account for clearing the panels of snow in the winter months.

Since electricity usage figures were not available, it is assumed the facility uses 10,000kWh per month at a cost of $0.10/kWh, that of a small to medium sized restaurant, due to the similar size. The selected PV system is capable of producing approximately 2,300kWh per month, approximately one quarter of the facility's energy demands (Harrington, 2011). Annually, if all of the power of the panels is harnessed, over $2,700 can be saved (Appendix D, Table D.5). This system works with a net-metering device, which would allow the flow of electricity back onto the grid in the case of excess production. This results in the meter actually spinning backwards and this is recorded as a 1:1 deduction on monthly bills. Based on these findings economic and financial, as well as the environmental and social repercussions, we recommend the installation of such a system at CamelTop so future energy savings may be realized.

Sustainable Kitchen Drainage

Several options and designs exist for mitigating the slick floor and water conditions in the kitchens. Strainers are a simple solution to the problem of clogging, but alternative drain designs or grease separation traps may also be favorable for the most efficient drainage

system that also reduce plumbing-related costs. It is also a priority to reduce or eliminate the use of anti-clogging chemicals which may already be used to clear the plumbing. Drain nets and strainers work at the source of the outfall and are made of durable stainless steel or polypropylene that is intended for high-temperature use up to 220ºF. These are a cheap and simple method of eliminating odors and clogged plumbing by capturing debris before they enter the system. Prices vary from only $2 for small plastic strainers to $75 for large diameter stainless steel strainers. See Appendix D, Table D.6.

Channel or trench drains systems (Figure D.2) offer a valuable, hygienic, and sustainable solution to traditional drains. These drains resemble rain gutters with a grate on top to run flush with the floor. Grates are able to be removed for easy cleaning access. There are a number of different patterns of grates including mesh, slot, ladder, diamond, and weave. It is our suggestion, that a relatively open grate be selected so as to avoid clogging issues. The type of grate selected will also have to take into account the different load ratings based maximum anticipated traffic, in accordance with American National Standards ASME A112.21.1M.

The ability for segments to be pieced together enables these drains to be installed in a way that allows proper drainage all of the necessary areas in CMR's kitchens. Channel drains are designed to collect accumulated substances from various places in the kitchen and channel them in a slope towards a central drain. Trench and channel drains come in a variety of styles, widths and materials ranging from different kinds of plastic to stainless or galvanized steel, copper, and concrete. Examples of possible options and vendors available for use in CMR's kitchens are shown in Appendix D, Table D.7; however, many other selections and combinations exist.

Research has shown that traditional electric garbage disposals increase the burden on grease traps as they thoroughly mix freshwater and finely chopped food materials. Instead of grinding the food waste and wasting precious freshwater for flushing, the strainer-drawer in garbage disposal replacement units GDRUs (Fig. F.3) strains solid particles under the pre-rinse sink when dirty dishes are being pre-rinsed, affecting a much

needed pretreatment process of restaurant wastewater (Drain-net, 2009). By ensuring that food waste is not flushed down drains, GDRUs eliminate backflows and do not allow the fouling of grease traps. Made of stainless steel and having no moving parts, these units help cut down on water and electricity costs that would be associated with traditional disposals. To clean, the collection tray is simply removed and cleared of food debris. Models are fairly similar, only varying in their height and are priced around $300.

Grease interceptors (traps) are an essential piece of kitchen plumbing equipment which strain grease that would clog plumbing if left unchecked. As shown in Figure D.4 inside the trap, grease floats to the top of the waste water and is retained while the water and food particles flow through and exit the system. While traditional steel traps can corrode due to high pH values or hard water, plastic traps offer a solution to this problem. These units are lightweight, durable, easy to install, and can last years longer than steel traps if properly maintained. The sizes of these systems are measured by grease capacity and flow rate, ranging from 10 - 150 pounds and 4 - 75 gallons per minute (GPM). Sizes of these system range from about 3 - 14 cubic feet. Without knowing the estimated flow rates of the facilities at CMR, exact model recommendations cannot be made at this time. These units are also intended for many fluids and built with fiber-reinforced plastic and will not have issues with hot water.

The items listed above for recommendation will save money over the long term by reducing maintenance of the plumbing system. Exactly how many hours of work the plumbing system has required or will in the future are unknown. However, since a plumber’s labor costs average $100 per hour, the installation of even the most basic drain strainers or GDRU has the potential to pay for itself in only one day’s worth of plumbing maintenance work. Additionally, compared to electric garbage disposals, which can range from $100 to over $1,000 for commercial units, the cost and operational sustainability of a $300 GDRU is easily realized. Finally, the improvements in sanitary and safety conditions will yield results that much more difficult to quantify.

Section 5: IT/Telecommunications

Introduction

This section contains assessments of possible methods for improving the current, insufficient telecommunications system found at CMR. As requested by the CMR staff, we investigated modern wireless solutions. Our analysis includes a topographical assessment of the mountain, which is used to identify possible problems that could occur in signal transmission. Several possible technological solutions were considered, analyzed and prepared, in order to attain one cost effective and technically sound proposal, which is presented at the end of the section.

Background

The key issue to be resolved involves interruptions of the landline voice communication service within the CMR complex. An alternative to using telephone cables for voice communication is to communicate via an Internet connection. Advancements such as Voice over Internet Protocol (VoIP) have created a niche in telecommunications and are poised to further penetrate the market.

Scope

Topographical Study

We used Google maps to study the topography of the site (Appendix E). The rectangular dimensions of the resort are about 0.9 miles (north-south) by 1.2 miles (east-west), yielding an approximate area of 1.08 square miles, or roughly 700 acres. The highest point, CamelTop is about 2,000 feet above sea level. The main lodge is at about 1,340 feet and the snow tubing area is at about 1,160 feet. It is about 0.47 miles from CamelTop to the less rugged terrain that the main complex is built on, at about 1,400 ft. Thus, the mountain has an average grade of about 24%.

Voice over Wireless LAN (VoWLAN) Solutions

This is essentially the use of VoIP on a Wi-Fi network. VoIP sends the audio as a digital signal over an Internet connection (Skype uses VoIP, for example). The advantages of VoWLAN are cheaper calls (including free calls to other VoWLAN units) and simplified integrated billing of both phone and Internet service (Geier, ch.1). One possible problem with VoWLAN is that the Wi-Fi network supporting voice applications must have significantly stronger signal coverage than what would be needed for most data-only applications. Another complexity is that the Wi-Fi network must be designed in such a way that it provides seamless roaming between wireless access points (WAPs) (Geier, ch. 2).

As such, the choice of network size is important to consider. A Campus Area Network (CAN), which consists of connected Local Area Networks (LANs), would serve to connect all of Camelback's buildings to a common network but would not be able to cover Camelback in its entirety. Another option, a small-scale Metropolitan Area Network (MAN), which combines LANs with additional technology that allows for network access over a large outdoor region, would sufficiently cover CMR. However,

MANs are costly and typically used by the public, not private, sector. In addition, external Wi-Fi doesn't penetrate into buildings, rendering it ineffective for many calling purposes.

Voice over Wireless LAN and 3G are similar in features, but VoWLAN uses a wireless internet network (typically IEEE 802.11 standards), rather than a cellular network. The latest 802.11 protocol, 802.11n, operates on both the 2.4 GHz and the lesser used 5.0 GHz band. Outdoor wireless range extends up to 250 meters. Data rates up to 600 Megabits per second can be achieved in an ideal setup (Stanford, 2007).

Mobile VoIP (mVoIP) Solutions

This emerging technology adds mobility to a network using VoIP. Through the use of special software clients, companies like Nokia have made mobile devices that can make VoIP voice calls (including internet calls). Coupling this technology with a MAN seems to be the only feasible way of being able to make calls anywhere on the mountain besides building a macro or micro cell tower. 4G networks, with their speed and reliability improvements over 3G networks, will be the platform for mVoIP. As 4G networks are rolled out by an increasing number of carriers, this technology will become more prevalent.

Results

This project would take the wired internet access available in both the Main Lodge building and in the coming Grand Lodge, create wireless networks, and transmit these signals across the mountain to create wireless networks at each end of the ski lifts, as well as CamelTop and the Camelback Lodge. In the proposed project, wireless routers are connected to a broadband Internet connection at the base of the mountain. Wireless bridges are then used to collect the signal and, when a directional antenna is used, transmit the signal over long distances. At the receiving end, either a repeater or a combination of another antenna and a wireless access point creates a wireless network at

the desired location. To combat signal transmission issues stemming from the steep grade of the mountain, we have taken advantage of the long, straight clearings needed for the ski lifts as alleyways through which the signal can be transmitted up the mountain. The existence of these alleys is important because signal propagation between antennas of this size requires a clear line-of-sight.

Figure 5.1: General Scheme for Long-Distance Signal Transmission (Hawking)

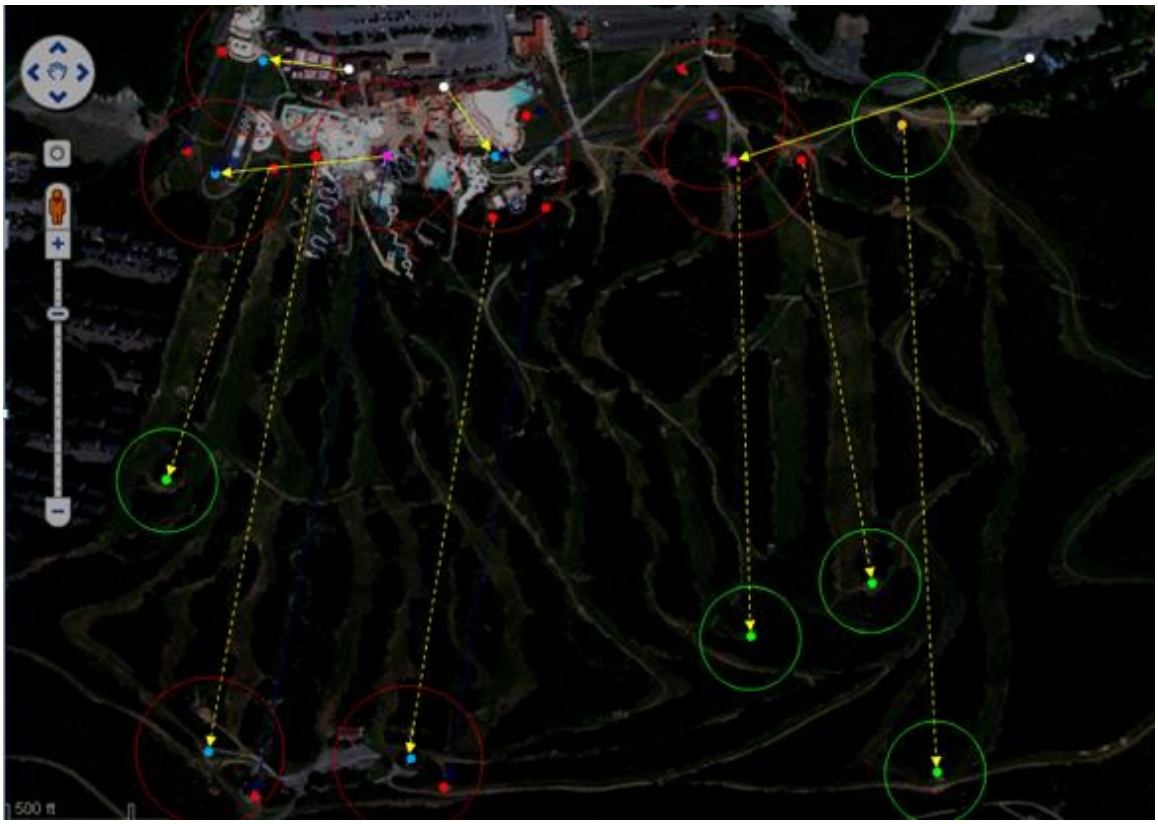
For the design of the system, we have chosen to incorporate devices using 802.11n, the newest version of the protocol used in Wi-Fi applications. Devices using this protocol generally have superior ranges and stronger signals than those of their 802.11a/b/g counterparts. While we have chosen to use technical components from one company, Hawking Wireless, the same general components are sold by several other electronics companies. All the prices for these components are quoted from one of Hawking's authorized resellers, Micro Center.

Table 5.1: Wireless Components

Code	Components	Cost ($)
A	Hi-Gain Wireless-300N Router	$63.99
B	Hi-Gain Wireless-300N Access Point/Bridge	$89.99
C	Hi-Gain 12dBi Directional Window Antenna	$59.99
D	Hi-Gain Outdoor Wireless-300N Dual Radio Smart Repeater	$269.99
E	Hi-Gain Wireless-300N Range Extender	$99.99
F	Hi-Gain 14dBi Outdoor Directional Antenna Kit, N-Plug Outdoor Cable Extension 30 feet	$99.99, $29.99

For 802.11n wireless routers, the indoor range (radial) is up to 300 ft indoors and 500 feet outdoors (Micro Electronics). These figures are highly dependent on router placement and the presence of obstacles to signal propagation. Since the routers in the Main Lodge building are fairly close to the outer walls, the signal should carry through the wall and continue outside. For the purposes of this analysis, we have assumed a router signal range of 300 feet. Should the designed configuration not be sufficient due to massive interference, employing a range extender (component E in the table above) is a simple fix. While it is not specified, the range of the wireless access point (component B) is assumed to be equal or less than that of the router because it uses the same number, two, and type, 3dBi Dipole Hi-Gain, of antennas as the router. To enable long range signal transmission, one of the antennas is screwed off and is replaced by a direction antenna. When possible, the window antenna (component C) is used instead of the more expensive outdoor directional antenna (component F). However, the more expensive model is needed for all instances where a signal is transmitted along a ski lift lane, since it can be more reasonably mounted and is contained in a weather resistant housing. These antennas have ranges of up to 1.5 (F) and 2 (C) miles (Hawking).

Figure 5.2: Designed System, Overlaid on Google Maps Image



On the image above, a node was placed at each end of the ski lifts, as well as at the designated router points. Each node color represents a different combination of components, as shown in the table below. The maroon and green circles represent the range of the networks created by the repeater and wireless access point units, respectively. The dark blue arrows represent the ski lifts, and the dotted yellow arrows represent ski lifts which are being used as signal alleyways by the directional antennas. Finally, the solid yellow arrows represent other antennas that do not use the ski lift clearings. By exploiting the clustering and roughly linear arrangement of some of these nodes, we designed this configuration for lowest price of components. This was done by minimizing the amount of repeaters, the most expensive component used. Thus, whenever possible, the wireless access point/antenna combination was used in place of the repeater, sacrificing the range of the network created for price.

Table 5.2: Wireless Component Distribution and Costs

Node Color	Node Quantity	Components	Cost ($) / Node	Total Cost ($)
Red	11	None	0	0
Black	2	A	63.99	127.98
White	3	B + C	149.98	449.94
Blue	5	D	269.99	1349.95
Orange	1	B + C + F	279.96	279.96
Purple	1	E	99.99	99.99
Green	4	B + F	219.97	879.88
Pink	2	B + D + F	399.97	799.94
				≈ **4000**

After compiling anecdotal data and conjectures for the expected service life of 802.11n, we have estimated a design life of eight years for our designed system. Note that while some components will almost surely fail before this time, the replacement cost of any single component is small enough to neglect in this approximate system costing.

For installation costs, we have assumed that each node will take approximately half an hour to set up, whether in mounting the components or programming them to meet the desired specifications. Also, from a survey of general wireless installation costs, we assumed that the rate charged by the wireless system installation service is $100/hour. Thus, the estimated installation and labor cost is given by:

$$0.5\ \frac{\boldsymbol{hours}}{node} * 100\ \frac{\boldsymbol{\$}}{\boldsymbol{hour}} * 29\ nodes = \$145\mathbf{0}$$

Voice will be achieved by using VoIP telephony. After investigating using cheaper phones using SIP transmission protocol, we determined that phones specifically configured for a service like Skype were a more economic option. This is because most SIP service providers charge flat rates per phone regardless of the recipient of the calls.

Conversely, Skype allows for free calls to other callers using Skype, meaning all intra-CMR communication would be free. Skype is very user-friendly and offers very cheap ($2.99/month) plans for unlimited calls to landlines and mobile numbers in the United States and Canada. This service can be utilized by phones in offices that handle calls from outside the company; in our analysis, we have assumed that four of these phones would be purchased, each with its own Skype service, with two of these being plugged into each router used in the Main Lodge building, and each of these. This incurs the annual charge:

$$2.99\frac{\$}{\frac{month}{phone}} * 12\frac{months}{year} * 2\frac{phones}{router} * 2\,routers \approx \$150$$

/year

The wired phone we have considered in this analysis was the XBlue SP2014 IP Phone, which can be bought from online sellers for about $100.00. Due to high volume of activity in the Main Lodge areas, two Belkin Wi-Fi phones for Skype wireless VoIP, which sell for about $150, have also been allotted to each router area. At each of the remaining communication points (i.e. all the nodes on the diagram), the purchase of one of these cell phones is assumed in our analysis.

Table 5.3: VoIP Phone Distribution and Costs

Node Color	Node Quantity	Phone Type	Phone Quantity	Cost ($) / Phone	Total Cost ($)
Black	2	Wired, Mobile	2,2	100,150	500
Other	18	Mobile	1	150	4050
					4550

Adding the components, phone, and labor/installation costs yields an initial project cost of approximately $10,000, with a $150 annual Skype service fee and a design life of eight years.

Section 6: Finance

Introduction

The main purpose of this section is to provide a framework for making decisions in an optimal manner considering both money and time as the determining variables in this process. For these decisions to be made optimally, we decided to use both a quantitative and a qualitative methodology. As such, we were able to devise a series of recommended capital improvement projects that can be adopted by CMR given their budgeting constraints as well as the need to replace and maintain various systems within the resort over the next five years.

Despite extensive research, a few assumptions had to be made, given certain limitations of this project. As a result, this section includes all the necessary information for Camelback to make their financial decisions, without dictating the timeline or sequencing of the projects. This detailed overview of recommended projects allows CMR to pick and choose which suggests to follow based on cash flow, preference and unforeseeable events.

Scope

Methods

Two complementary approaches were used as benchmarks upon which Camelback can base its decisions. The qualitative method includes a prioritization of each individual project based on two main criteria: urgency and need. Each project area prioritized their different alternatives on the basis of how crucial they considered the implementation of their project(s) to be in terms of solving the basic problems that they were set forth to address. In addition, each section was asked to include a value judgment on where they situated each alternative on the basis of a scale that extended from basic necessity to luxury item so that Camelback can have a better idea of which alternative to choose in the case of many. While this approach is more subjective, the second method employed is based entirely on quantitative analysis.

The technique used to analyze the different project alternatives is based on annual worth analysis. This technique is preferred over present worth analysis because it captures the uncertainty associated with decisions that are made over projects that have different design lives. This takes into account initial cost, maintenance costs, and an estimate of possible savings for each individual project.

It is important to note that the results presented are only close approximations, as prices may vary from year to year, and additional costs may be incurred during the actual implementation of the project. More specifically, depending on the chosen contractor and any further unknowns that are not included in the costs of purchasing, procurement, labor, and maintenance, costs may be higher or lower than estimated. Additionally, savings may be higher than estimated as well, since the cost of water or electricity is volatile, and the exact overall consumption at CMR was not disclosed.

Results

The purpose of this section was to provide necessary information, which will allow Camelback to make informed decisions regarding the various recommended capital improvement projects. Figure F.1 is a comprehensive chart of each project with its companying costs. An annual worth analysis was completed, factoring in initial cost, design life, planned maintenance costs and potential savings. For the latter, it's important to note that extremely conservative numbers were used, and many savings, such as improved customer experience and employee safety, did not have quantifiable savings.

Using the background information and input from CMR management, solutions were prioritized based on imposing threat and potential savings. The projects were categorized into high, medium and low level priority; these delineations are color coded, and can be seen in the last column of Figure F.1. Specifically looking at the Food Service projects, the upgrading of the three kitchens is designed to be a phased process, with the Cameltop Kitchen being of top priority, followed by the Main Kitchen in the Main Lodge and the Bistro Kitchen in the Main Lodge.

All dollar values were converted into 2011 dollars, in order to facilitate comparison between projects regardless of design life. Also, a discount rate of 1.24% was used in the annual worth calculations in order to account for the opportunity cost of not earning interest from a savings account (Rate taken from Ally Bank, with the highest local interest rate).

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Appendix A: Building Capital Projects

Figure A.1. Layout of the Main Lodge roof (Google Earth, 2011).

Table A.1. Estimated square foot calculation of Main Lodge roof.

Section	Area (sqft)
1	4,752
2	2,880
3	8,000
4	3,439
5	8,798
6	4,416
7	1,005
8	10,087
Total	42,376.50

Contractor Information

Century Waterproofing
78 Sherman Ridge Road
Sussex, NJ 07461
Sean at (973) 702-0226

B-DRY System of Northeastern PA
179 Laurel Road
Spring Brook Twp, PA 18444
Bob at (570) 848-2454

Blakeslee Home Improvement Inc.
Mackes Road
Blakeslee, PA 18610
Michael at (570) 855-5855

Appendix B: Water/Restrooms

Table B.1: Panasonic WhisperGreen Models from Panasonic ideals for life

Model #	Description	Unit Price
FV-05VK3 50 CFM 4" Duct	WhisperGreen® 50 CFM Ceiling Mounted Ventilation Fan with DC Motor	$240.00
FV-08VK3 80 CFM 4" Duct	WhisperGreen® 80 CFM Ceiling Mounted Ventilation Fan with DC Motor	$250.00
FV-08VKS3 80/0 CFM 4" Duct	WhisperGreen® 80 CFM Ceiling Mounted Ventilation Fan with DC Motor and Variable Speed Controls	$280.00
FV-08VKM3 80/0 CFM 4" Duct	WhisperGreen® 80 CFM Ceiling Mounted Ventilation Fan with DC Motor, Variable Speed Controls, and Motion Sensor	$308.00
FV-13VK3 130 CFM 6" Duct	WhisperGreen® 130 CFM Ceiling Mounted Ventilation Fan with DC Motor	$299.00
FV-13VKS3 130/0 CFM 6" Duct	WhisperGreen® 130 CFM Ceiling Mounted Ventilation Fan with DC Motor and Variable Speed Controls	Price from Dealer
FV-13VKM3 130/0 CFM 6" Duct	WhisperGreen® 130 CFM Ceiling Mounted Ventilation Fan with DC Motor and Variable Speed Controls	$355.00

Table B.2: Lossnay ERV from Mistubishi Electric. Pricing from Ecoheats.

Item Name	Item #	Nominal Diameter	Unit Price
Energy Recovery Ventilators	LGH-F300RX3-E	8 in. (203mm)	$2199.07
Energy Recovery Ventilators	LGH-F470RX3-E	10 in. (254mm)	$2569.99
Energy Recovery Ventilators	LGH-F600RX3-E	10 in. (254mm)	$3132.03
Energy Recovery Ventilators	LGH-F1200RX3-E	14 in. (356mm)	Awaiting Information

Table B.3: RenewAire Vseries from HvacQuick.com

Item Name	CFM	Nominal Diameter	Unit Price
V80	80	4 in. (101m)	$140.00
V110	110	4 in. (101mm)	$155.00
V150	150	6 in. (152mm)	$195.00

Table B.4. High efficiency toilets

Brand	Model	GPF	Unit Cost	Total Toilets	Total Cost
American Standard	Awfall	1.28	$372	83	$30,876
Kohler	Kingston K-4325	1.28	$196	83	$16,268
TOTO	Aquila*	1/6/0.8	$350	83	$29,050

TOTO Aquila is a dual flush toilet

Table B.5 High efficiency urinals

Brand	Model	GPF	Unit Cost	Total Urinals	Total Cost
American Standard	FloWise	0	$481	29	$13,949
American Standard	Washbrook FloWise	0.5	$551	29	$9,309
American Standard	Albrook FloWise	0.5	$321	29	$15,979

Table B.6 High efficiency sinks

Brand	Model	GPM	Unit Cost	Total Sinks	Total Cost
Toto	TEL3LSC-10	0.5	$385.05	25	$19,252.50
Sloan	ETF-600	0.5	$369.99	25	$18,499.50
Delta	Arzo Series 3586LF-MPU	1.5	$362.00	25	$18,100.00

Figures B.1 – B.3: Savings for Toilets, Urinals, and Sinks calculations.

Used current national average cost of water per 1,000 gallons, which is $6.06.
Based on flushes per day, the calculations determined the saving in money based on the difference in gallons of water used between the toilets, sinks, and urinals currently used at Camelback and the ones we proposed.
Also assumed 7 flushes/uses per day based on research.

Figure B.1: Urinals
There are 29 urinals
Current urinals at Camelback use 1.0 gallons per flush
The American Standard Flo-wise Flush Free Waterless which we chose uses 0.0 gallons per flush
Savings in Gallons 74,095/yr
Savings in Money $449/yr

Savings Dollars per Year

$6.06	1 gallon	7 flushes	365 days	29 urinals	=	**$449.02**
1,000 gallons	flush	day	year			**year**

Savings Gallons Per Year

1.0 gallons	7 flushes	365 days	29 urinals	=	**74,095 gallons**
flush	day	year			**year**

Figure B.2: Toilets
There are 83 toilets; 74 use 1.6gpf and 9 use 1.3 gpf
The Kohler Kingston K-4325 uses 1.28 gpf
Savings in Gallons 60,502/yr
Savings in Money $367/yr

Savings Dollars per Year

$6.06	1.6 gallon	7 flushes	365 days	74 toilet	=	**$1,833.22**
1,000 gallons	Flush	day	year			**year**
$6.06	1.28 gallon	7 flushes	365 days	74 toilet	=	**$1,466.58**
1,000 gallons	Flush	day	year			**year**
				subtract	=	**$366.64**
						year

Savings Gallons Per Year

1.6 gallons	7 flushes	365 days	74 toilets	=	**302,512 gallons**
flush	Day	year			**year**
1.28 gallons	7 flushes	365 days	74 toilets	=	**242,009.6 gallons**
flush	day	year			**year**
			subtract	=	**60,502.4 gallons**
					year

Figure B.3: Sinks
There are 50 sinks; 37 use 0.5 gpf and 13 use 2.2 gpf
The TOTO TEL3LSC-10 uses 0.5 gpf
Savings in Gallons 56,465/yr
Savings in Money $342/yr

Savings Dollars per Year

$6.06	2.2 gallon	7 flushes	365 days	13 sinks	=	**$442.82**
1,000 gallons	flush	day	year			**year**
$6.06	0.5 gallon	7 flushes	365 days	13 sinks	=	**$100.64**
1,000 gallons	flush	day	year			**year**
				subtract	=	**$342.18**
						year

Savings Gallons Per Year

2.2 gallons / flush	7 flushes / day	365 days / year	13 sinks	=	**73,073 gallons / year**
0.5 gallons / flush	7 flushes / day	365 days / year	13 sinks	=	**16,607.5 gallons / year**
			subtract	=	**56,465.5 gallons / year**

Appendix C: Food Services

Table C.1: Pricing of Dura Chef 7/8" Drainage Mat (Taken from Floor Mat Company, 2011)

Matt Size	1-9 Units	10-24 Units	25-99 Units	100+ Units
7/8" x 38.5" x 58.5" Black	$82.00	$75.85	$69.70	$61.50
Dura-Chef Connectors	$1.50	$1.50	$1.50	$1.50

Inventory

Main Lodge – Main Kitchen

Appliance	Manufacturer	Model
Large Kettle	Grown	Not Found
2 Steamers	Groen	SSB-5E
2 Convection Ovens	Southbend	Not Found (rubbed off)
Walk in Fridge	Bohn	---
Walk in Freezer	Bohn	LET 0901F
Broiler	Nieco	Not Found
Hot Box	Alto Sham	1000 UP
Fryer System (filter magic fry master)	Manitowoc	---
Griddle	Hobart	CG41
Flat Top Oven	Hobart	---
2 Refrigerators	Traulsen	GHT 1-32 WUT
2 Ice Machines	Manitowoc	Series 1000
Ice Storage Bin	Follett	Not Readable

Main Lodge – Bistro Kitchen

Appliance	Manufacturer	Model
2 Pizza Ovens	---	---
4 Burner Range (stove) (propane)	---	---
Cooler (4 drawers)	---	---
Warmer/Holder	---	
Electric Grill	---	---
Hood Vent	---	---
3 Propane Fryers	---	---
Refrigerator/Holder	---	---
Ice Machine	---	---
2 Units containing a refrigerator and freezer each	Traulsen	---
Cooler/Salad Station	---	---
Steam Station	---	---
Kettle	---	---
Warmer Surface	---	---
Coffee Machine	---	---
Hot Chocolate Machine	---	---
2 Warmers	---	---
Steam Table (single element)	---	---
2 Coolers	---	---
Churro Holder	---	---

Cameltop Kitchen

Appliance	Manufacturer	Model
Steam Box	---	AT1L300
Range (stove)	Garland	1201805
Grill	GE	CC58
Grill	STAR	D016020
Fryer	Hotpoint	HKB8
Fryer	GE	CK20
Refrigerator	Traulsen	Not Found
Refrigerator	Traulsen	GLT 2-32 NUT
Ice Box	Manitowoc	Series 450
Small Refrigerator	Silver King	SKF2A
Pie Case (cooler)	Silver King	SKDC48PT
Small Refrigerator	Bohn	R35 series
Steam Table	---	---
Pretzel Machine	J & J Snack Food Corp	JJ85OB
Churro Machine	---	---
Coffee Machine	Gemini System	312L
Hot Chocolate Machine	---	pc-2-10
Soda Machine	Servend	MD 150
Ice Cream Machine	Dippin Dots	---
Walk in Freezer	TAF CO/TMP Co	10-8-F-NR
Refrigerator	Traulsen	GHT 2-32 NUT
Refrigerator	Traulsen	GHT 2-32 NUT
3 Coolers	Beverage Air	---
Italian Ice Freezer	---	---

Appendix D: Sustainability

Table D.1: Federal incentive programs of interest to sustainability improvements at CMR (DSIRE, 2010).

Federal program	Applicable technologies	Amount	Notes and conditions
Energy Efficient Commercial Buildings Tax Deduction	HVAC, lighting, hot water…	$0.60 – 1.80/ square foot	Improvements must reduce energy usage ≥ 50%. Funding depends on overall energy reduction
Business Energy Investment Tax Credit (ITC)	Wind, solar, geothermal, biomass …	% of expenditures	30% credit for wind, solar; 10% credit for geothermal
Department of Treasury Renewable Energy Grants	Wind, solar, geothermal, municipal solid waste …	$ varies with production	10-30% of the basis of the property where technology used
Renewable Electricity Production Tax Credit (PTC)	Wind, geothermal, municipal solid waste, biomass…	1.1-2.2¢/kWh	Applies for first 10 years of operation

Table D.2: Pennsylvania state incentive programs of interest to sustainability improvements at CMR (DSIRE, 2010).

State program	Applicable technologies	Amount	Notes and conditions
DCED - Alternative and Clean Energy Grant/Loan Program	Efficiency upgrades (HVAC, appliances, etc); wind, geothermal, feasibility studies	1-5% fixed rate loan *i* rate	Grants available for green building projects, feasibility studies, energy savings contracts
Pennsylvania Green Energy Loan Fund	HVAC, lighting, appliances, hot water, windows, roofs, solar, wind, geothermal	$100k-2.5M loan; 4.0-6.5% *i* rate up to 15 years	Project must result in an estimated energy consumption reduction of at least 25%

Table D.3: PP&L incentive programs of interest to sustainability improvements at CMR (PPL Electric, 2011).

PP&L program	Applicable technologies	Amount	Notes and conditions
ePower Rebates	Lighting, energy reduction, HVAC, custom incentives	Full and partial rebates; reduced energy costs per kWh …	Various programs may renew or expire before expiration date as funds are exhausted Should be frequently monitored to assure rebates are still available at time of improvements.

Figure D.1: Aerial view of CamelTop, showing three separate roof sections: A (yellow), B1 and B2 (blue) (Google Earth, 2011). Only south-facing sections are being considered for optimal PV placement.

Table D.4: Roof area calculations to determine solar output.

Roof Section	Length (ft)	Width (ft)	Area (ft^2)
A (North-facing)	54	42	2,268
B1 (South-facing)	72	22	1,584
B2 (South-facing)	18	66	1,188
Total Area (South facing)			2,772

Table D.5: Calculations for annual savings associated with 21.120kW PV system versus purchase from PPL.

Output, kW; kWh/month	$/kWh from PPL	Annual savings
21.120kW; 2,300kWh/mo	$0.10	$2,760

Table D.6: Drain-net and tray strainers prices (Drain-Net, 2011).

Model	Size	Material	Price	Comments
Mesh Sink Strainer	11"; 2" lip	Stainless	$40	Removable, fits over sink
Square Floor Basket	6.5"/8.5"	Plastic	$20/22	8.5" has handle
Round Floor Basket	9.5"	Plastic	$19	
Mop Sink Basin Strainer	21"x21"x8"	Plastic	$50	Includes 5 filters
Molded Drain Net	2", 3", 4" dia	Plastic	$8	Drops into drains
#10 Mesh Drain Net	2", 3", 4" dia/ 4", 6" L	Stainless	$60 – $76	Price dependent on specific size

Figure D.2: Sample image of typical kitchen trench drain installed (trenchdrains.biz).

Table D.7: Trench and channel drain options (Blucher, NDS, 2011).

Brand	Model	Width	Price*	Comments
Blucher	BTO-6	7-3/4”	$640/ft	+ $820 per outlet box
	BTV8	11-1/4”	$1110/ft	Direct drain
NDS	DS-090N	3.99”	$130/ft	Trench only
	DS-601	3.74”	$104/2ft	Weave grate
	830	8”	$50/20”	Shallow profile channel
	838	8”	$125/20”	Load Star grate
Zurn	Z890	4”	210/ft	Sani-flo

Figure D.3: Garbage disposal replacement unit; typically mounted underneath sink drains to strain out food and debris from entering plumbing (drain-nets.com)

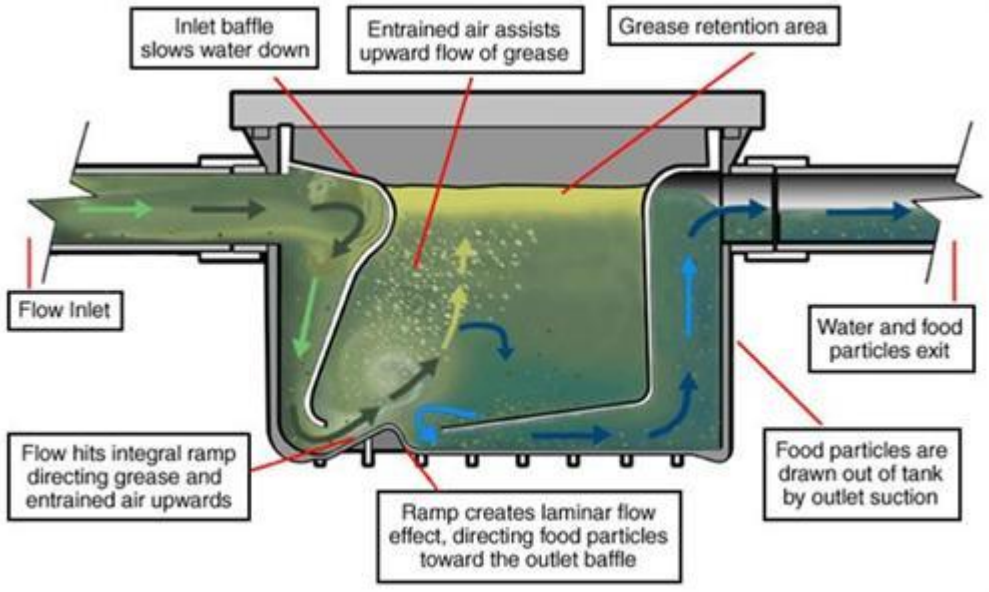

Figure D.4: Inner-workings of a recommended plastic grease interceptor (drain-nets.com)

Appendix E: IT/Telecommunications

Camelback Topography

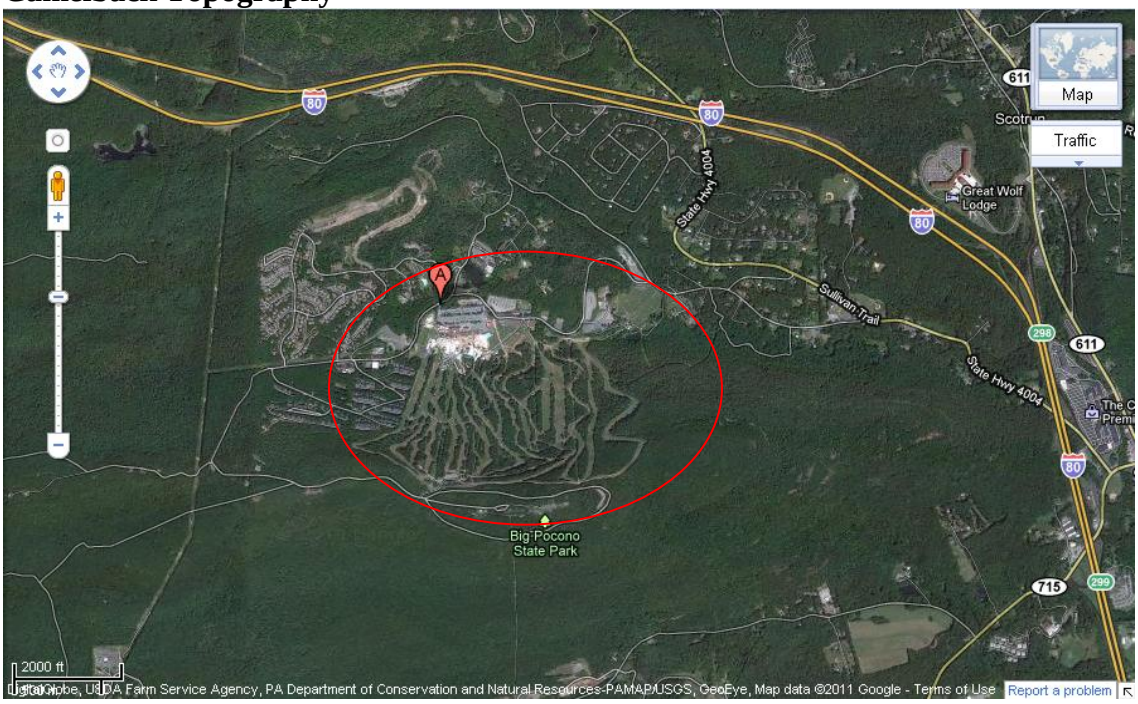

Figure E.1: Camelback Satellite Imagery

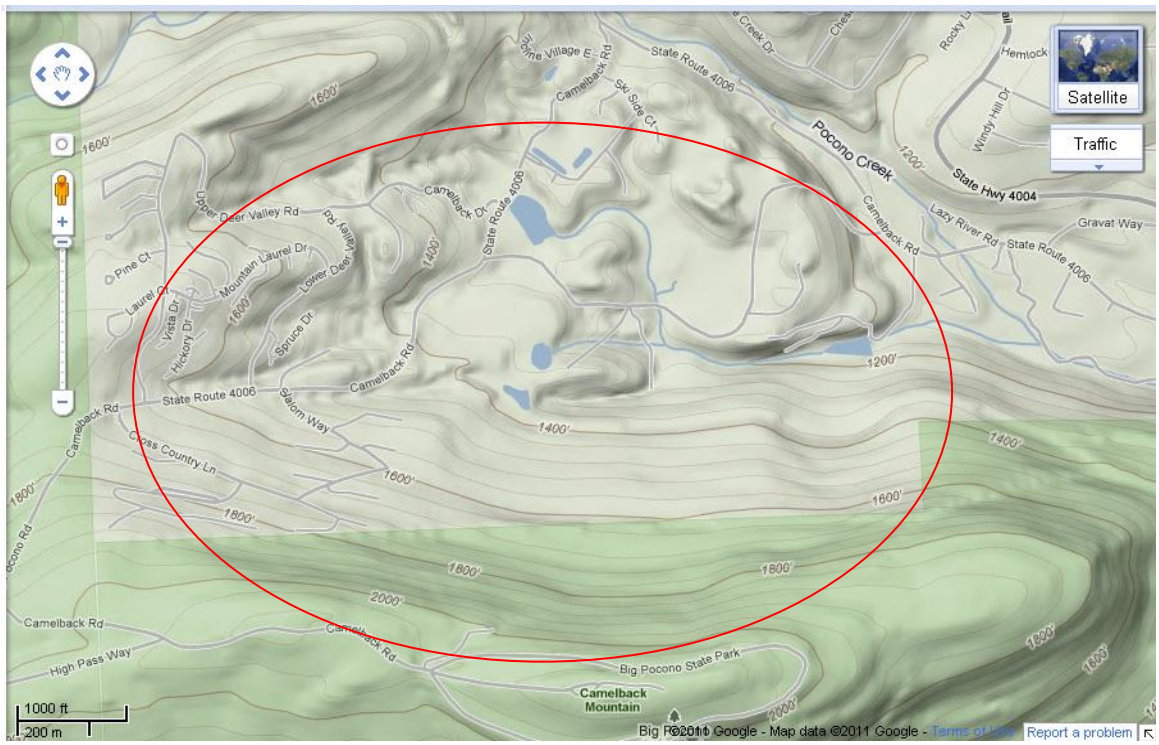

Figure E.2: Camelback 3D View

Appendix F: Finance

	Annual Worth	Present Value	Initial Cost	Design Life	Annual cost	Maintenance	Savings	Notes	Phase
FOOD									
Cameltop Kitchen	-$3,115	-$29,129	$42,500	10	$1,430	0	$1,430	**installation costs not included	1st Kitchen
Main Lodge, Main Kitchen	-$697	-$6,514	$20,400	10	$1,485	0	$1,485	**installation costs not included	2nd Kitchen
Main Lodge, Bistro Kitchen	-$2,877	-$26,904	$42,800	10	$1,700	0	$1,700	**installation costs not included	3rd Kitchen
Service Elevator - Main Lodge	-$2,275	-$48,648	$85,000	25	$1,700	0	$1,700		
SUSTAINABILITY									
Cameltop PV System	-$1,502	-$37,439	$100,000	30	$2,510	$250	$2,760		
Kitchen Drainage	-$82	-$2,561	$5,700	40	$100	0	$100	per kitchen	
IT									
WLAN Network	-$1,471	-$11,136	$10,000	8	-$150	$150	0		
BUILDINGS: CAPITOL PROJECTS									
Foundation Repairs - Main Lodge	-$296	-$9,300	$9,300	40	0	0	0		
Roofing - Main Lodge	-$4,449	-$95,138	$93,000	25	-$100	100	0		
Deck Foundation - Cameltop	-$79	-$4,500	$4,500	100	0	0	0		
Leaky Windows Cameltop- caulking	-$48	-$230	$230	5	0	0	0		
Leaky Windows Cameltop - replace	-$1,362	-$24,000	$24,000	20	0	0	0		
WATER									
Hard Water*	-$337	-$12,500	$12,500	50	0	0	0	*divided by wells	
Annex	-$27	-$1,000	$1,000	50	0	0	0		
Fireside	-$51	-$1,900	$1,900	50	0	0	0		
Ski Repair	-$51	-$1,900	$1,900	50	0	0	0		
Security	-$27	-$1,000	$1,000	50	0	0	0		
Coolmoor	-$27	-$1,000	$1,000	50	0	0	0		
Discovery	-$51	-$1,900	$1,900	50	0	0	0		
Big Pocono	-$51	-$1,900	$1,900	50	0	0	0		
Thirsty Camel	-$51	-$1,900	$1,900	50	0	0	0		
Ventilation	-$189	-$2,570	$2,570	15	0	0	0	per bathroom	
Low-Flow Fixtures	$75	$2,794	$13,900	50	$450	$400	$850		
PA Room	-$15	-$545	$2,400	50	$50	$100	$150		
Ski Repair	$39	$1,465	$4,100	50	$150	$100	$250		
Security	$11	$410	$3,300	50	$100	$100	$200		
Coolmoor	$39	$1,465	$4,100	50	$150	$100	$250		
TOTALS	-$18,515	-$305,206	$463,830						

Cameltop
Main Lodge
high
medium
low

All numbers are estimations of complete project costs unless otherwise noted. Full calculations can be found in the respective sections

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