

5. Evaluation of Alternatives

In considering the alternatives for this project, complete avoidance, alternate locations, and **minimization of impacts were considered**. Avoidance is discussed in Section 6 of this application. The alternative locations and sizes along with efforts to minimize the impact to stream and wetlands are discussed below.

The other criteria for the alternatives involve **land ownership** and/or ease of acquisition, proper **zoning** for a recreational lake, **distance and travel time** to a body of water that is large enough to use a crew boat and a motor boat capable of pulling a skier. The **size of water surface area** and volume of water that LU considers reasonable is related to the previously mentioned factors. **Safety of the public** is always an important item to be considered at the outset of any project.

Land ownership and/or being able to obtain or manage the land is also a key factor in making a project feasible. The proposed project is on property that Liberty University owns. The alternative analysis below discuss the ownership of the location analyzed. Some options are not feasible specifically because property ownership or control is not possible. Land ownership is also important for storage of equipment and boats. If public boat ramps are used, hauling of equipment for each encounter is required. This increases the wear and tear on the boats and equipment and increases the potential for theft and destruction of the University's property.

Proper zoning for a recreational facility such as a lake is sometimes a barrier to a project like this. The University has experienced opposition to rezoning property in the past because local residents do not want the traffic and students near their property. This has caused planning commissions to block rezoning property for Liberty. The property for the proposed lake is appropriately zoned for this use.

Figure 4-1 shows a crew course on the proposed surface area of the lake. It also shows a water ski course and a triathlon swim course. The **size of surface water** needed for these activities is the minimum water surface area considered for alternatives. This proposed lake is 29 acres with a length of 2,700 feet and an average width of 300 feet. The length and width are also critical factors to fitting these courses into a surface area.

Distance from the University was also a critical factor. The number of miles students must travel for sporting practices, events or courses is important. Liberty wants to minimize the amount of time students must travel to allow more time for them to study and take courses. This is a factor that could limit academic success.

If a laboratory or practice facility is an hour away from campus and the class or the practice lasts for two hours, the students are away from campus for 4 hours and drivers are tied up for 5 hours. This reduces their amount of study time and time for other courses and extracurricular activities. The risk of negatively impacting academic success reduces the participation in these types of activities.

Distance also costs the school money in fuel and wear on university vehicles. At 60 miles one way for a practice, the university would be spending approximately \$0.53 per mile. They would also be paying drivers capable of driving a van for the students and a driver pulling the boats and equipment for each practice. These costs are detailed below:

Vehicle cost = Van rental @ \$100.00 per day + (120 miles x \$0.75 per mile) =

= \$190.00 x 2 vehicles = \$380.00 per trip

Personnel cost = \$13 per hour x 5 hours x 2 employees per trip

= \$130.00 per trip

Cost per semester = 4 practices per week x 18 weeks x \$510.00

= **\$36,720.00**

If the facility was at the current location as proposed, there are already transportation routes set up for access to this facility from main campus and campus east. Since this is LU property, they will not have to transport equipment for each practice. It can be stored on site. This will also reduce the wear and tear on boats and trailers.

Safety of the students, faculty and public is incredibly important to Liberty University. The university recognizes this and is being proactive in trying to replace the existing dam. The new dam will be engineered and soil will be tested throughout construction to ensure that it meets modern construction standards.

The proposed design for the lake and road realignment has been examined by many engineers, LU staff members and government agencies. This proposed design combines all of the safety concerns of these groups and is by far the best design for this facility.

The following safety features are included in this design:

- Shortest dam length of alternatives examined-reduces chances of dam failure
- Spillway cut into natural grade – reduces chance of failure of the dam during flood events and spillway activation.

- NRCS Two-Way Covered Riser – safer intake structure for protection of people and wildlife
- Re-alignment of Camp Hydaway Road – significant improvement of the existing VDOT road to make a safer travel way.
- The permitting process will require flood inundation mapping for the proposed dam. The existing dam does not currently have flood inundation mapping and an emergency action plan for a dam failure. Having this plan in place will greatly improve safety for the public downstream and motorists using Camp Hydaway Road.

The following sub-sections describe the many alternatives considered and how each alternative meets or does not meet the criteria set forth above.

A. Alternate Locations for Dam within 10 miles of Liberty University

(i) Current Lake Location & Size

There is *an existing 6 acre lake* at this location. This lake is **not large enough** to support the growing recreation need of the students, the additional course offerings and additional sports offerings. If the lake were left in place, the University would not be able to expand and grow as needed.

Liberty is known for a diverse array of activities outside of the classroom. This is a unique quality that most colleges do not have and this has allowed the University to grow at a very rapid pace. Young adults enjoy the outdoors and need to expend energy. The facilities on the LU campus are as diverse as they are entertaining. From an artificial ski slope to paintball fields, there is something for every student to enjoy.

Expansion of this lake to continue to grow these facilities is critical. Not expanding is not an option because more open water is needed as discussed in previous sections for additional courses, club offerings and sporting competitions.

As discussed above, **safety** is also a major concern for the University. The principal spillway pipe is clogged and has been clogged for several years. The pipe has been evaluated with a TV camera to see the obstructions. There is no way to clear the obstructions without completely removing the pipe. Options such as pipe slip lining and pipe drilling mechanisms have been explored. The obstruction is in a bend and it is impossible to fix it without a complete replacement.

A temporary fix for this issue was to alter the emergency spillway, which was done in the fall of 2015, making it the primary spillway. The dam would have to be breached and the water completely drained to fix this pipe.

The material the current dam is constructed of is of more concern than the clogged principal spillway. As described in the report included in Appendix F, the dam core is not made of material that is suitable by today's standards. If Liberty University has to spend the money and time to replace it, they want to ensure the new project meets the current needs of the University, TRBC and LCA. Many facilities on the campus have been upgraded to meet the current needs of the fast growing campus and this facility is no exception.

This option doesn't meet size requirement criteria, therefore it is not a practicable alternative.

(ii) Upstream Location

Upstream and downstream locations within the Liberty University property boundaries were evaluated. The one that was studied extensively, but not used is shown in Figure 5-1. This option does not provide the same amount of surface area, is more expensive to construct and is a safety concern for long term maintenance.

The option shown in Figure 5-1 utilizes a natural narrow passageway on Opossum Creek. It has a concrete emergency spillway that is part of the dam. This spillway has 10 foot long energy dissipating blocks that would be poured monolithically with the spillway.

This design caused concern for Liberty University due to the extensive amount of concrete. This would have been very costly. They were also concerned about the safety aspects of this spillway. In the event of emergency spillway activation, the water velocity would be very high and cause significant downstream erosion. In the event of catastrophic failure, this massive concrete spillway would cause serious destruction downstream.

The location of the dam was moved slightly further to try to gain more surface area, but the same problems were encountered with the spillway. Moving the dam slightly further to connect with the natural high point or knob beside Camp Hydaway Road did not have the height needed to keep the water at the existing water

surface elevation. This is a program issue for LU since the existing buildings and docks will be used. The designers proposed raising the elevation of the knob with clay material, but LU and the design engineers had stability concerns about this design.

The normal pool elevation was very close to the same elevation as Camp Hydaway Road in the options. After much study, major changes to the road would be needed to avoid overtopping. Therefore, these locations did not work due to safety and cost concerns.

This option doesn't meet the size requirement criteria, dam safety criteria or cost criteria. This is not the Least Damaging Practicable Alternative.

(iii) Alternate Locations

A survey of alternate locations within approximately 10 miles of the school has been performed. *This is the same travel time from LU Main Campus to the proposed lake location.* The criteria used was presence of a perennial stream, adequate watershed drainage area, potential downstream impact, potential wildlife impact, land disturbance and public access.

Off-line ponds were not considered because the topography is not suitable in this area of Virginia because of mountainous terrain. The slopes on either side of the proposed lake are too steep to consider an off-line pond. In order to construct an off-line pond here, a significant amount of dirt would need to be moved and over half of the perimeter of the lake would be a dam. Construction of an earthen dam this long is not feasible or logical.

Perennial channels were the only areas considered because they provide enough fresh water to keep the lake healthy for wildlife and human recreation. They also provide the most logical geographical shape for a pond. These areas require the least amount of excavation. Minimized excavation reduces pollution to the downstream watershed.

The area to the south and west of the campus naturally has the best topography for creating a lake. The area to the west and north of the campus is the City of Lynchburg and is heavily developed. There is no practical area north and west of the campus to create a lake.

The potential alternative areas for lake creation and/or expansion are shown on Figure 5-2. The following is an assessment of each location that was analyzed:

- a. **Site 1**–Site 1 is the proposed location for the lake. It is the best location for many reasons. The main reason is that the University already **owns the property** and is using the existing lake as a recreation facility. The current **zoning** is appropriate for the project. The proposed expansion will add additional open water in order to have more activities and outdoor recreation opportunities, therefore the **size** criteria is met.

The existing location has a perennial stream, Opossum Creek, flowing through it. This will provide enough fresh water input to keep the lake healthy for wildlife and human recreation.

The drainage area of the watershed is approximately 2,000 acres. This is enough acreage in the south central region of Virginia to provide adequate water to keep the lake full but not too much to require alternative construction methods, such as a concrete dam.

The downstream impact will consist of tree clearing, structure and road relocation. The areas surrounding the proposed lake are forested with mature hardwoods trees.

The public access to this proposed lake is existing and it meets the **distance criteria** from main campus. The Camp Hydaway entrances and parking facilities will be used. Therefore, additional deforestation will not be required for access.

A new dam in the proposed location would meet the **safety** criteria set forth above since it would be a newly constructed dam that meets the Virginia Department of Conservation and Recreation standards for earthen dams. The design will be stamped by a professional engineer and oversight with materials testing will be provided during construction.

This is the best option for the project. It meets all of the criteria described above. This is the Least Damaging Practicable Alternative.

- b. **Site 2** – In looking at the appropriate area within a short driving distance of Liberty, an existing lake was analyzed as a desktop exercise. Pine Lake is owned and maintained by a residential community just south of Liberty’s main campus. This lake is an amenity attached to the home values of the residents in the community.

The stream that feeds this lake is not a bold flowing stream and the drainage area is too small to support a large lake.

The land and wildlife disturbance associated with expanding this lake would be similar to the proposed lake, however the wetland impact would likely be more based on the topography.

Dam safety is also something to strongly consider at this site. The dam would be just upstream of US Route 29. A catastrophic failure of the dam would very likely cause loss of life on this very busy section of highway. Therefore, it is not a prudent location to create a large lake.

There is no public access to this lake. The homeowners access it from their properties. If Liberty were to attempt to purchase these parcels, they would have a significant investment *in the parcels and in parking and building facilities. An expenditure of this magnitude is not practicable.*

Since the Pine Lake homeowners would never allow LU to expand their lake and the University already owns land that is more suitable than this location, they would not consider purchasing this property. Based on the reasons above, this is not a viable site for Liberty to do a lake expansion.

This option fails because of the land ownership criteria and dam safety concerns. This is not the Least Damaging Practicable Alternative.

- c. **Site 3** - In looking at the appropriate area within a short driving distance of Liberty, another existing lake was analyzed as a desktop exercise. Willow Lake is owned and maintained by a residential community southeast of

Liberty's main campus. This lake is an amenity attached to the home values of the residents in the community.

The land and wildlife disturbance associated with expanding this lake would be similar to the proposed lake, however the wetland impact would likely be more based on the topography. The floodplain area on both sides of the stream is wide, suggesting more wetland impact than the proposed site. Floodplain disturbance is also of concern since they provide significant benefits in groundwater recharge.

Dam safety is also something to strongly consider at this site. The dam would be just upstream of US Route 501 and a railroad. A catastrophic failure of the dam would very likely cause loss of life on this very busy section of highway. Therefore, it is not a prudent location to create a large lake and DCR would not likely permit this potential dam.

There is no public access to this lake. The homeowners access it from their properties. If Liberty were to attempt to purchase these parcels, they would have a significant investment in parking and building facilities. An expenditure of this magnitude is not practicable.

Since the University already owns land that is more suitable than this location, they would not consider purchasing this property. Based on the reasons above, this is not a viable site for Liberty to do a lake expansion.

This option fails because of the land ownership criteria and dam safety concerns. This is not the Least Damaging Practicable Alternative.

- d. **Site 4**—Site 4 is a location on Flat Creek selected for the proximity to main campus. This location has sufficient water since the creek is a bold perennial stream with approximately 8,224 acres of drainage area. This drainage area and stream flow are likely too much for an earthen dam to accommodate. Alternative construction materials would likely be needed which would not be economically feasible.

The land and wildlife disturbance associated with expanding this lake would be similar to the proposed lake, however the wetland impact would very likely be more based on the topography. The floodplain area on both sides of the stream is wide, suggesting more wetland impact than the proposed site. Floodplain disturbance is also of concern since they provide significant benefits in groundwater recharge.

Liberty University does not own this property, therefore property acquisition would be a significant portion of the cost of the project. This property is not currently for sale and is in multiple parcels. Since the University already owns land that is more suitable than this location, they would not consider purchasing this property.

This option fails because of the land ownership criteria and dam safety concerns. This is not the Least Damaging Practicable Alternative.

In conclusion, none of these *alternative sites* have less impact for the size lake needed by the University than the proposed location. All of the alternatives will have **more environmental impact** due to the amount of clearing and deforestation needed.

In addition to wetland and stream impacts, impervious surfaces would need to be added to the alternative location in the form of parking lots, buildings, walks, etc. that will increase water runoff in the James River watershed and add to the nutrient load. These facilities already exist at the existing lake.

B. Permanent Removal of Existing Dam

Removal of the existing dam with no replacement is not an option for Liberty University. The University, Liberty Christian Academy and Thomas Road Baptist Church all have built programs and have spent tremendous resources with the upkeep and construction of facilities at this lake. The lake is part of the campus infrastructure surrounded by recreation trails and fields.

Removal of the dam without replacement would also destroy a long time open habitat for fish and other wildlife. The wetlands around the lake would also be drained and would dry up. These wetlands serve as nutrient

filters for the James River and wildlife habitat. This is not a feasible alternative to expanding Camp Hydaway Lake.

This option doesn't meet project needs, therefore it is not a practicable alternative.

C. Increased Use of Ivy Lake

Ivy Lake was owned by Liberty University, but is not any longer. This lake was sold to Runk and Pratt in March of 2017, which is a nursing home business in the Lynchburg area (see sale agreement in Appendix B). It is to be officially transferred upon enhancements to the dam spillway expected to occur later in 2017.

This option does not meet the land ownership criteria, therefore it is not a practicable alternative.

D. Use of Daniel Island and Treasure Island in the James River

Liberty University owns two islands in the James River. LU pursued the use of these islands for recreation several years ago but could not get access to them. LU owns property on the Amherst County side of the river, just upstream of the islands, but **could not obtain a Special Use Permit** from the County to construct a dock and parking area for students and faculty.

This was a zoning issue and during the public hearings, local residents protested use of the property by Liberty for recreation. The local residents and business owners were very opposed to Liberty using the property to construct a dock and parking area (see Appendix B for opposition letters). The river bank is very steep on the property and a dock and stairs are the only way to access the river (See Figure 5-3 Alternative Locations – James River).

Since the SUP was not issued, Virginia Marine Resources would not issue the permit to allow construction of a dock to launch boats. They also would not issue a permit to construct a dock at the islands in the James River since there was no way to get to them.

These islands are also subject to flooding and have flooded in the past. This is also a reason not to invest in significant infrastructure there. Infrastructure is already constructed at Camp Hydaway and is only minutes from campus. The islands are approximately a 20 minute drive from campus and are not on the bus route. This complicates transportation and reduces study time for students. This is not a feasible alternative to expanding Camp Hydaway Lake.

This option does not meet the zoning criteria, therefore it is not a practicable alternative.

E. Use of Red and Dots private boat launch in James River

Red and Dots is a private boat launch and store along the James River across from the islands owned by Liberty. The owners of this business were totally opposed to Liberty's Special Use Permit request on the property just upstream (as discussed above). They were threatening to Liberty staff and would not allow LU staff or LU consultants to launch boats from their boat ramp (see letter from surveyor in Appendix B).

The owners of Red and Dots also led the neighborhood charge against LU in the Special Use Permit process. They spoke against the rezoning at the public hearing and encouraged others to do so as well.

This option does not meet the ownership criteria, therefore it is not a practicable alternative.

F. Use of Leesville Lake or Smith Mountain Lake

Leesville Lake is in Pittsylvania County and is approximately 45 minutes in driving time from campus. Smith Mountain Lake is in Bedford, Pittsylvania County and Franklin Counties. The closest access point is 45 miles from Liberty. These lakes are surrounded by private property and are difficult to access. LU does not own any property at either lake. Purchasing property and developing infrastructure like the buildings and trails that already exist at Camp Hydaway would be cost prohibitive.

Even if public boat launches were used, the distance would significantly limit the amount of students that could use the lake(s). It would also eliminate one of the proposed uses of the lake which is an outdoor classroom. The amount of driving time would not be feasible for a class to do on a routine basis. The distance would also limit the use of the lake by LCA students.

Public boat ramps would also limit the storage of boats and equipment at the lake. This increases the risk of lost and/or damaged property. This is not a feasible alternative to expanding Camp Hydaway Lake.

This option does not meet the distance criteria, therefore it is not a practicable alternative.

G. Use of Monacan Park on the James River

The Monacan Park boat ramp is 20 miles from the LU campus. It is a very small area operated by Amherst County for the public. It has a few parking spaces and bathrooms. The distance would significantly limit the amount of students that could participate in the sports and other activities described in this application. It would also eliminate one of the proposed uses of the lake which is an outdoor class room. The distance would also limit the use of the lake by LCA students.

This location does not meet the distance criteria, therefore it is not a practicable alternative.

H. Road Alternatives

The relocation of Camp Hydaway Road (Route 677) in Campbell County is being proposed in support of the construction of a new Camp Hydaway Dam, which will expand existing Camp Hydaway Lake. During the conceptual design process, multiple alternatives were considered for the roadway horizontal and vertical alignment. Each alignment was analyzed from an environmental, safety, constructability, and cost perspective in order to determine the preferred alignment.

The alternatives for road realignment included avoidance and minimization, no build, and examination of different types of structures to span environmentally sensitive areas. The alignment was developed based on the location of the proposed dam and the normal pool elevation of the proposed lake.

The road alignment objectives were **minimization** for the amount of road to be realigned and adherence to the VDOT guidelines for vertical and horizontal geometry. These factors guided the design engineers to the alignment shown in Figure 1-4. The streams and wetlands were also considered and impacts to them were reduced as much as possible.

Some alternative structures were evaluated to try to span the wetlands and streams.

i) Open Bottom Culverts

Open bottom culverts were evaluated. These structures are more expensive than a standard culvert by a factor of 2. They also require a footing below the ground surface on either side of the stream. In our past experience with construction of these in low lying areas, the groundwater influence causes constant problems and requires stream alteration and constant pumping. These things drive the price up and increase the schedule significantly.

Additionally, when open box culverts were considered to reduce stream impacts, calculations were done to evaluate stream

velocities. Due to high flow rates and velocities, rip rap lining would have been necessary to mitigate erosion under the culverts, which would impact the streambed.

Open bottom culverts are cost prohibitive and schedule prohibitive. Due to high stream velocities, they would also have to have the stream bed lined with rip rap, causing the same impact as a culvert. Therefore, open bottom culverts are not practicable alternative.

ii) Bridges

The use of bridges over wetlands and streams was explored for this project. The traffic volumes were too low (<900 VPD) to justify the high capital cost of bridges. There are also high maintenance costs associated with bridges. Therefore, VDOT does not warrant bridges as practicable alternatives for low volume roads.

Due to high capital cost and ongoing maintenance costs, bridges are not practicable alternative to span the wetlands and streams for the road construction.