

IMPACT OF HIGH WATER ON CARLYLE LAKE FACILITIES

January 2006

1. Introduction:

- a. General: Carlyle Lake project purposes are flood control on the Kaskaskia and Mississippi Rivers, domestic and industrial water supply, navigation releases for the Kaskaskia River, recreation, water quality enhancement and fish and wildlife conservation. Carlyle Lake is a 26,000-acre reservoir located on the Kaskaskia River at river mile 94.2 and has a drainage area of 2,717 square miles. The Corps operates five intensively developed recreation areas and the State of Illinois has two intensively developed recreation areas on the lake. The Corps manages 9 boat ramp locations and the State manages 7 boat ramp locations on Carlyle Lake.
- b. Study Goal and Objectives: This study describes the impact of high water on boat ramps and land-based recreation facilities. Alternatives and recommendations to maintain visitor access during high water events are discussed and cost estimates are provided. The management goal during high water events is to provide safe high water ramps on the open water at well-distributed, functional locations and provide access to land-based recreational facilities. The following are specific objectives for high water facilities (All elevations are in feet NGVD):
 - 1) At a minimum, provide public access to the open lake and recreational facilities to 456 and higher elevation where feasible. Fishermen and other boaters will continue to desire access to the lake at elevations above 456. For these users and other visitors, where feasible and economically reasonable, ramps should be maintained or elevated to 460.
 - 2) Provide or construct sufficient parking at high water boat ramps that is useable during high water events.
 - 3) Provide complete breakwater protection to 455 where necessary and economically feasible.
 - 4) Provide an adequate number of high water ramp lanes at each ramp to maintain efficiency (one for one minimum, two for four lanes optimum).
- c. Analysis Assumptions and Considerations: The following factors were considered in evaluating the impact of high water and identifying solutions.
 - 1) Most visitors will continue to use the lake for recreation between 450 and 456.
 - 2) Most Corps of Engineers managed recreation facilities effectively close at elevations above 456.
 - 3) Higher ground around Carlyle Lake is limited; therefore, relocation of facilities, especially the land-based facilities, is impractical. Furthermore, entrance roads were not designed for higher lake levels and in certain locations become flooded, cutting off access to recreational facilities on higher ground. In some instances, if access to areas during high water events were available, a significant number of recreation facilities could be open to the public.
 - 4) Visitors come to the lake to recreate on the water, but need the land-based support facilities (picnic sites, restrooms, campsites, beaches, showers, marinas, etc., that are generally not available above 455). Therefore, fewer boat ramps are needed above 456 since visitation is less.
 - 5) Eldon Hazlet State Park facilities (campsites, cabins, pool, picnic sites) are located above elevation 460; however, the road to the park becomes inundated at 456.4. Elevation of the entrance road would allow access to many recreation facilities during high water.
 - 6) Loss of visitation occurs during high water events and results in significant local negative economic impacts (primarily in counties within 30 miles of the project).
 - 7) Inflow into the lake has increased by over 30 percent over the last 10 years possibly due to increased precipitation or other factors.
 - 8) The lake will continue its flood control mission providing downstream flood prevention on the Kaskaskia and Mississippi Rivers in the future in accordance with the water control plan and that will result in higher lake levels on an intermittent basis.
- d. Reference:

- 1) Design of Recreation Areas and Facilities – Access and Circulation – 1982, Chap. 4.
- 2) Carlyle Lake Watershed Technical Committee, *Carlyle Lake Watershed Plan*, 2002. The Carlyle Lake Watershed Plan planning committee consisted of 28 members representing villages, soil and water conservation districts, drainage districts, the Mid-Kaskaskia River Basin Coalition, environmental groups, farmers, politicians, businesses and the Carlyle Lake Association.
- 3) Southwestern Illinois RC&D, Inc. *Kaskaskia River Watershed*, 2002

2. Background Information: Previous Flood Impacts and Renovation Efforts

After a record high water event in 1995, the Corps completed several renovations which allowed more facilities to be functional at pool elevations between 450.0 and 455.0. These renovations have lessened the negative impacts to recreation users and the local economy.

Renovations to the Coles Creek Recreation Area were made, including shoreline revetment, raising low areas of roads within the recreation area, raising all campsites in Loop 1 to a higher elevation; replacing campground electrical to allow for the electrical shutoff on specific campsites based on elevation and constructing impact sites for easier cleanup on sites that are susceptible to inundation. Other repairs included repairing damaged campsites in the Boulder Recreation Area and constructing impact sites adjacent to those sites susceptible to inundation, replacing campground electrical to allow for electrical shutoff on specific campsites based on elevation in the Boulder and Dam West Campground, rebuilding eroding campsites and placing revetment on a portion of the shoreline in the Dam West Campground and completing repairs/revetment to numerous areas around the lake where erosion has occurred. In addition, the Keyesport and Boulder marina breakwaters were repaired and raised to provide additional protection to the marina harbors during future high water events.

Also, several additional high water launching lanes were constructed: a single lane ramp in the Boulder and Coles Creek Recreation areas and a double-lane ramp in the Dam West Recreation Area. The IDNR also constructed a high water ramp at the Apache Boat Ramp. These ramps are useable when the regular launching lanes become unusable, i.e., at higher lake levels. In addition, a lane was added to the Dam East high water boat ramp.

3. Statement of Problem:

a. General: High water levels in recent years, have at times, hindered the public's ability to use the lake and land-based recreational facilities. Lake water levels at 450 and above impact Carlyle Lake recreational facilities. As water levels rise, more facilities are impacted. These impacts are detailed in the *Standard Operating Procedure for High Water at Carlyle Lake, Illinois* plan that also identifies actions to be taken to maintain the safety of visitors and prevent damage to facilities. Ultimately, all Corps recreation areas are closed at 456 due to flooding of the facilities themselves or the access to those areas.

b. High water events cause significant impacts to the local economy when they result in the shutdown of recreational facilities around the lake (i.e., boat ramps, campgrounds and day use areas). A report entitled *Recreation Visitor Spending Profiles and Economic Benefit to Corps of Engineer Projects*, produced by the Corps' Environmental Lab in December 2003 studied the local economic impacts of Corps projects. In 1999 the report indicated that campers that boat spent \$65.03 per person per trip and day-users that boat spent \$19.75 per person per trip in counties within 30 miles of the Carlyle Lake project. Total economic impact in 1999 was \$583,319 for campers that boat and \$9,637,013 for day use boaters. If some or all of the land-based recreational facilities are closed for many days during the recreation season, the economic impact is felt locally. The Carlyle Lake Watershed Plan stated that a 20 to 40 percent reduction in

business occurs¹ when flooding impacts the use of recreational facilities. In 2002, if 30 days of the recreation season had a 50 percent reduction, it would have equated to a 1 to 1.5 million dollar loss in counties within 30 miles of the project. Individuals and businesses have requested the Corps to improve access to the lake when the water levels are high to lessen the local economic impacts and allow visitors to use the lake. They indicated that putting out the official word that the lake is “closed” reduces visitation and impacts local businesses. They expressed hope that access to the water and land-based recreation facilities could be maintained during future high water events.

c. **Lake Levels:** According to statistics supplied by the Corps’ Hydraulics Branch, lake levels were higher and stayed higher more often in the last twenty years than in the project’s first twenty years. Duration of water levels for those two time periods is shown in Table 1.

Table 1 – Duration of Water Levels

DURATION				
1965 – 1984			1985 – 2004	
LEVEL	TOTAL*	PERCENT	TOTAL*	PERCENT
>= 456.00	0	0.0	34	0.5
>= 455.00	26	0.4	49	0.7
>= 454.00	73	1.0	91	1.3
>= 453.00	128	1.8	161	2.2
>= 452.00	234	3.3	264	3.7
>= 451.00	415	5.9	403	5.6
>= 450.00	615	8.7	540	7.5

* cumulative days over corresponding elevation

d. **Breakwaters:** At Boulder and Dam East main ramps, wave action discourages boaters from launching or makes for unsafe launching conditions due to incomplete breakwater protection or the lack of breakwater protection.

4. **Inventory:** Carlyle Lake has 18 boat ramp *locations* (grouped by shading in Table 2) , 14 of which are located at open water locations. Because the open water locations provide better access to the lake and have more parking available, these ramps were the focus of this study.

a. As shown in Table 2, of the open water ramps, 13 ramp *locations* are still functional when the water level reaches 450, 10 are functional when the lake is at 453, and 6 are functional at 456. The ramps that are still functional at 456 are distributed well geographically, but are limited by parking, number of lanes, their design, or the lack of breakwater protection which discourages use. A map with the location of boat ramp facilities is included as Plate 1.

Table 2 – Existing Boat Access Sites

Boat Ramp	Elevation at which Ramp Closes	Design Problems	Breakwater Protection Needed on:	Entrance Road Not Open at High Water	Notes	Parking
Boulder Main	451.5	Low el.;	N-NW		4-lane; incomplete breakwater protection	Sufficient
Boulder High	460	Yes – slope	N-NW		1-lane	Sufficient
Coles Creek Main	451	Low el.			4-lane	Sufficient

¹ Carlyle Lake Watershed Plan, 2002, pg. 16

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Boat Ramp	Elevation at which Ramp Closes	Design Problems	Breakwater Protection Needed on:	Entrance Road Not Open at High Water	Notes	Parking
Coles Creek High	456	Yes – slope	N-NW		1 –lane	Sufficient
Coles Creek Sailboat	450	Shallow water	N/A		1-lane	Sufficient
Deer Run	447	Silted in at inlet entrance	None	Closes 452	1 lane gravel	Sufficient
Dam East Main	451	Low el.	North		4-lane	Sufficient
Dam East High Water	456	Yes – steep ramp	West (minimal)		2-lane	Sufficient
Dam West Main	451	Low el. and launching ramp traffic circulation	E & N (done)		4-lane	Sufficient
Dam West High	456	None			1-lane	Sufficient
Carlyle Sailing Assc.	452 – cabin boats; 455 – trailerable boats	No launch ramp for cabin boats above 452	To complete facility protection	Closes 456	1-lane	Sufficient
Hazlet Apache, IDNR	450	None	N/A	Closes 456.4	2-lane	Sufficient
Apache High Water, IDNR	459.9	None	N/A	Closes 456.4	1-lane	Sufficient
Allen Branch, IDNR	450.5	Low el.	N/A	Closes 452	4-lane	Sufficient
Peppenhorst	450	Low el.; shallow water	N/A	Closes 456.4	1-lane gravel	Minimal
Keyesport Main	453	Low el.			4-lane	Sufficient
Tamalco	453	Channel silted in at normal el.			1-lane	Sufficient
Patoka	453	Channel silted in at normal el.			1-lane	Sufficient
Horseshoe Island	457	Limited Parking			1-lane	Insufficient parking
Cox Bridge	454.5				Not on open lake	Sufficient
Wood Duck	452				1-lane, not on open lake	
North Fork	453				1-lane, not on open lake	
Hitogi	452				Not on open lake	

b. Land-based Recreation Facilities: As shown in Table 3, land-based recreational facilities, i.e., campgrounds, day use areas and marinas are closed as the lake rises. At elevation 455, most land-based facilities are closed.

Table 3 – Land Based Recreation Facilities

Location	Closure Elevation
Dam West Campsites: 5	450
Boulder Campsites: 6; Coles Creek Campsites: 9; Coles Creek Beach Showerhouse and Beach; McNair Beach; Tamalco, Patoka, and Dam East boat ramps;	451
Dam West Campsites: 21; Coles Creek Campsites: 27; Boulder Campsites: 14; Dam West, Coles Creek, Boulder and Allen Branch Main Boat Ramps; Dam West Beach; Coles Creek Beach Shower Building:	452
Dam West Campsites: 30; Coles Creek Campsites: 54; Boulder Campsites: 24;	453
Dam West Campsites: 35; Coles Creek Campsites: 73; Boulder Campsites: 46;	454
Coles Creek , Boulder , Dam West; Close Entire Campgrounds	455
All recreation areas	456

Several resource concerns have been identified:

1) The terrain around Carlyle Lake is relatively flat and there are no available locations that have the elevation necessary to support a campground or picnic area or reasonably close to the lake itself. Eldon Hazlet State Park has recreational facilities located at 460 and above that could provide recreational opportunities if the entrance roadway was elevated from 456 to 460 or 462.5. In addition, smaller campgrounds at South Shore State Park, McNair and East Spillway can remain open during high water events.

2) The Kaskaskia River Watershed plan produced in the summer of 2002 by the Southwestern Illinois Resource and Conservation District in cooperation with the Corps of Engineers and Illinois Department of Natural Resources included recreation objectives related to high water such as assisting the private sector in developing business opportunities focused on recreation and developing high water infrastructure facilities at Carlyle Lake². Infrastructure facilities would include boat ramps, campsites and recreational sites.

5. Plan Formulation - Proposed plans for public access improvement have been formulated based on staff knowledge and experience, public input and various planning documents.

a. **Corps Areas**

1.) **Boulder Recreation Area:** The Boulder main ramp elevation is 450 and the high water ramp elevation is 460. The main ramp experiences problems with wave action from the north and northwest. The four-lane main ramp is inundated at 451.5 and then only the one-lane high water ramp is available. The break over angle at the top of the high water ramp is incorrect and trailers in excess of 20' long have insufficient underside clearance..

Three alternatives have been identified to address the demand for high water access:

Alternative 1 would raise the main ramp to 454. The lower southwest corner of the Boulder boat ramp is at 450 and could be raised to 454. Making the four-lane ramp useable to 454

² Kaskaskia River Watershed Plan 2002, pg. 34

would cost \$165,300 including contingencies. Average annual benefits are estimated at \$32,252, generating net benefits of \$22,668 and a benefit-cost ratio (BCR) of 0.64.

Alternative 2 would correct the existing high water ramp and add an additional lane to the high water ramp to increase efficiency. This alternative with contingencies would cost \$51,500. Average annual benefits are estimated at \$3,415 generating net benefits of \$429 and a benefit-cost ratio (BCR) of 1.14.

Alternative 3 would raise the boat ramp parking lot and main ramp to 460. Parking would not be impacted as the water elevation rises and the four lanes would allow efficient access. The cost estimate for raising the boat ramp and parking lot to 460 is \$842,264. Average annual benefits are estimated at \$37,943, generating net benefits of negative \$10,892 and a benefit-cost ratio (BCR) of 0.78.

Recommendation: Alternative 2: Rehab the existing high water ramp to correct the design problem and add an additional lane.

Breakwater : The existing breakwater at Boulder was designed to protect boaters while they launch and to protect the ramp from wave action from a southwestern direction. There are fewer problems in the summer months, but in the fall and winter, during the hunting season, the wind shifts to the north-northeast. Wave action caused by these winds further damages the ramp and causes additional siltation of the boat ramp. Without complete breakwater protection, boat launching is difficult and visitor safety is compromised. The proposed solution is to extend the breakwater from the shore opposite the end of the breakwater to the northwest approximately 115 feet into the lake. The breakwater will be constructed of approximately 4,150 tons of 400 lb. riprap; the base of the breakwater will be approximately 60 feet in width, the crown will be approximately 20 feet in width, and the height will be built to approximately 455. The construction of this additional breakwater would eliminate the current problems experienced at the ramp and decrease the amount of damage to existing facilities. Cost is estimated at \$90,000. Extension of the breakwater at the main ramp would protect the existing government investment during flood damage reduction operations.

Conversion of Picnic Sites to Campsites: During flood damage reduction operations, campsites become inundated and have to be closed. This results in lost revenue and a decrease in visitor services. Picnic sites located in the Boulder Picnic area are largely unused due to a shift in the public's demand for day use facilities. To reduce the number of unused picnic sites and provide needed camping as well as increase revenues, it is proposed to convert 8 picnic sites to 8 full-service campsites.

Proposed Action: As shown in Table 4, eight picnic sites would be converted to campsites in the Boulder Day Use Area at elevation 460. Estimated cost is \$87,900. As shown in Table 5, the benefit cost ratio is 1.3.

Recommendation: Convert eight picnic sites to campsites in the Boulder Day Use Area.

Table 4 – Campsite Relocation Costs

Boulder Day Use - 8 Campsites	Unit Cost	Total 8 Sites
Sites with Impact Areas	\$5,443/site	\$43,544
Water and Sewer Hookups	\$3,000 ea.	\$24,000
Extend Access Road 425 ft.	\$61.61./ln.ft..	\$26,184
Electric service	\$1,915/site	\$15,320

Electrical Panel	\$2,875 ea.	\$2,875
Total		\$87,900
Cost per site Boulder Relocation	\$11,225	

Table 5 – Campsite Cost Benefit Ratio

<u>Benefits</u>	Annual
Item	Entire Project
Increased Fee Collection (increase \$6.00/campsite/hookup)	(\$20 per campsite; 50 % occupancy)
Total Revenue	\$8,400
<u>Costs</u>	Annual
Initial Construction Costs 20 years at 5.375	\$6,473
Benefit/Cost Ratio	1.3

2.) **Coles Creek Recreation Area:** The Coles Creek main boat ramp is operational to 450 and the high water ramp to 456. The high water ramp has design problems similar to the Boulder high water ramp; vehicle/trailers greater than 20 feet have limited underside clearance at the top of the ramp due to the incorrect break over angle of the ramp. The entrance road to the ramp is inundated at 456; therefore, no alternatives with higher elevation than 456 are proposed. Two alternatives have been proposed:

Alternative 1 would renovate the high water ramp to correct this problem. Cost is estimated at \$12,900. No breakwater is proposed for this location. Average annual benefits are estimated at \$1,707, generating net benefits of \$958 and a benefit cost ratio (BCR) of 2.28.

Alternative 2 is to raise the ramp and the entire parking lot to 455. This will provide sufficient parking. Cost is estimated at \$688,867. Average annual benefits are estimated at \$40,961, generating net benefits of \$1,020 and a benefit-cost ratio (BCR) of 1.03.

Recommendation: Alternative 1: Rehab the existing high water ramp to correct design problems.

3.) **Dam East:** The two-lane high water ramp at Dam East is useable to 456 and is partially protected by a breakwater. The issues here are limited parking in the immediate area and the potential for this area to be the location of a resort that would require removal of the high water ramp. The main ramp is four-lanes, but it is low (451) and not protected by a breakwater. Presently, there are three alternatives.

Alternative 1 would relocate the ramp to the northeast corner of the parking lot and place a ramp off the riprap directly to the lake. Cost of adding a new ramp in the NE corner of the main parking lot is \$38,845. Average annual benefits are estimated at \$9,334, generating net benefits of negative \$21,909 and a benefit-cost ratio (BCR) of 0.30

Alternative 2 would raise the Dam East four-lane main ramp and parking lot to 460. That cost is \$731,230. If the resort plan is implemented, this may be the only viable alternative since the resort would require the land where the other alternatives are planned. Average annual benefits are estimated at \$28,000, generating net benefits of negative \$14,396 and a benefit-cost ratio (BCR) of 0.66.

Alternative 3 would rehab the existing high water ramp. Rehabbing the high water ramp would require excavating the adjacent slope to the SE and adding two additional ramps. Estimated cost is \$117,350. This would result in a four-lane high water ramp that is located in a protected location and usable to elevation 460. Sufficient parking is available at the Dam East main parking lot. The slope of the existing ramps would remain the same. Average annual benefits are estimated at \$15,750, generating net benefits of \$8,946 and a benefit-cost ratio (BCR) of 2.31.

The existing high water ramp breakwater would be raised to elevation 460 at a cost of \$122,198.

Recommendation: Alternative 3: Because there are no immediate plans for a resort development, rehabilitating the existing high water ramp to include two additional ramps at elevation 460 and raising the existing highwater ramp breakwater is the best option.

4.) **Dam East Breakwater:** The Dam East main boat ramp has no current protection from flooding, and wave action from the northwest. This causes damage to facilities as well as additional siltation of the boat ramp. Visitors using the ramp during heavy wave action have a difficult time launching and retrieving boats causing concern for public safety. The breakwater would be extended northeast approximately 100 feet into the lake and will be constructed of approximately 4600 tons of 400 lb. rip-rap. The base of the breakwater will be approximately 60 feet in width, the crown will be approximately 20 feet in width, and the height will be built to approximately 455. The construction of the additional breakwater would eliminate current problems and decrease the amount of damage to existing facilities and would cost \$500,000. If this is not constructed, the boating public could use the high water ramp for launchings when the lake is rough, especially if the high water breakwater is raised (see Dam East Alternative 3).

5.) **Dam West Recreation Area:** The Dam West main ramp elevation is 450 and the high water ramp elevation is 456. Recently, the breakwater was improved by extending it to the Northeast and raising it. Although adequate access during high water is available at Dam West, raising the main ramp and parking lot would provide more parking during high water events. Proposed solutions include the following:

Alternative 1: Raise Dam West boat ramp parking lot to 460. Sufficient parking and all four lanes would be useable. Estimated cost is \$1,578,750. Average annual benefits are estimated at \$227,593, generating net benefits of \$136,053 and a benefit-cost ratio (BCR) of 2.49

Alternative 2: Continue to operate ramps as usual, but improve efficiency by providing additional staff members during high water events to monitor parking and provide visitor assistance. Add additional docking pier adjacent to the existing docking pier at elevation 456 at a cost of \$20,000.

Alternative 3: Raise Dam West boat ramp and parking lot to 456. Estimated cost is \$1,087,125. Average annual benefits are estimated at \$177,014, generating net benefits of \$113,982 and a benefit-cost ratio (BCR) of 2.81.

Recommendation: Alternative 2: Continue to operate the main boat ramp as usual and add on to the existing docking pier.

6.) **Dam West Recreation Area - West Abutment:** To provide public and service access to 472, a new ramp would be constructed at the west abutment to the main dam. A ramp from 450 to 472 could be placed on the existing rip rap and opened when lake levels reach 456. Limited parking is available. Estimated cost is \$16,610. Average annual benefits are estimated at \$1,156, generating net benefits of \$193 and a benefit-cost ratio (BCR) of 1.20.

7.) **Keyesport Recreation Area:** Multiple fishing tournaments departing from the Keyesport Recreation Area as well as popularity of the ramp for access to recreation on the north end of the lake create a large demand for parking in the Keyesport area as well as an efficient ramp that operates to 455.

Keyesport Boat Ramp: The Keyesport boat ramp is closed when the lake level reaches 453.

Alternative 1: The proposed plan is to raise the ramp apron from 453 to elevation 455. The cost estimate for the project is \$119,770. Average annual benefits are estimated at \$29,315, generating net benefits of \$22,371 and a benefit-cost ratio (BCR) of 4.22.

Alternative 2: Raise ramp and parking lot to 457. This option would provide additional parking during high water events as well as access above 455. Cost estimate is \$597,523. Average annual benefits are estimated at \$36,643, generating net benefits of \$1,999 and a benefit-cost ratio (BCR) of 1.06.

Alternative 3: Raise ramp and parking lot to 460. This option would provide maximum parking as well as permit use to the highest lake elevation. Cost estimate is \$978,613. Average annual benefits are estimated at \$43,972, generating net benefits of negative \$12,978 and a benefit-cost ratio (BCR) of 0.77.

Recommendation: Alternative 1: Raise existing apron from 453 to 455.

8.) **Horseshoe Island:** Horseshoe Island boat ramp parking will be reconfigured to create more car/trailer parking.

9.) **Tamalco:** The ramp closes at 451.5. Area is open to 453.1 when the access road to the ramp is used as a high water ramp. The channel off the boat ramp silts in and does not permit lake access at low water. There are no plans for improving boat access at this area.

10.) **Patoka:** The ramp closes at 451.5. Area is open to 453.1 when the access road to the ramp is used as a high water ramp. Shallow water off the boat ramp prevents large boats from using this area at low or summer pool lake levels. There are no plans to improve this area.

11.) **Wood Duck:** The ramp closes at 452. This ramp is not on the main lake. There are no plans to improve the ramp at this area.

b. **State Park Areas**

1.) **South Shore State Park - Deer Run:** Located on a small inlet on the east end of South Shore State Park, this ramp has three problems: the channel to the open water is silted in at the entrance to the lake, it has a low elevation (447) and the entrance road floods at 452. Two alternatives have been proposed.

Alternative 1: The State Park management has proposed relocating the park road on the east end of South Shore State Park to provide improved access to a future lodging location, avoid impacts to the endangered Massasauga rattlesnake and provide access during high water events to the east end of the park. This alternative would relocate the Deer Run boat ramp to higher ground (456) at the mouth of the inlet when the State Park loop road development is implemented. Cost is estimated at \$90,766. Average annual benefits are estimated at \$9,752, generating net benefits of \$4,490 and a benefit-cost ratio (BCR) of 1.85.

Alternative 2: Raise ramp in present location to 452 (entrance road low elevation) and dredge out the mouth of the inlet. Average annual benefits are estimated at \$3,706, generating net benefits of negative \$41,717 and a benefit-cost ratio (BCR) of 0.8.

Recommendation: Alternative 1: Relocate the ramp to higher ground at entrance to cove if the proposed South Shore State Park loop road development is implemented.

2.) **Eldon Hazlet State Park - Entrance Road:** The entrance road to Hazlet is inundated and closed at lake elevation 456.4 and that prevents the use of all recreation facilities in the park. Eldon Hazlet State Park has recreational facilities located at 460 and above that could provide recreational opportunities during high water events if the entrance roadway was elevated.

IDNR is proposing to raise the entrance road in partnership with the Corps. If the entrance road was raised to 460 or above, approximately 80% of facilities would be open for use including loop roads, comfort stations, campsites, a high water ramp, cabins, a swimming pool and a store. Further engineering study by the Corps will determine the cost and extent of the road raise necessary to provide optimum access during high water events.

3.) **Apache Ramp:** The Apache boat ramp is operable to 450. A separate one-lane high-water ramp adjacent to the main ramp is operable to 459.9. If the entrance road is raised, adding an additional high water ramp at this location would be beneficial. The IDNR would incur all costs of the construction. Cost is estimated at \$30,046. Average annual benefits are estimated at \$2,553, generating net benefits of \$811 and a benefit-cost ratio (BCR) of 1.47.

4.) **Allen Branch:** Allen Branch boat ramp is operable to 450.4. Renovations are planned in 2006 for Allen Branch at Hazlet State Park that will include rehabbing the boat ramp (to 5-lanes with a transfer station), courtesy docks, parking areas, and riprap areas. New items include a fish cleaning station and universally accessible provisions for boat access. Construction is scheduled for 2006. In a separate action it is proposed to replace 20 vault toilets, 3 shower buildings and 50-75 full service hookup sites within the park

5.) **Peppenhorst Branch:** The ramp closes at 449.9. Shallow water off the boat ramp does not allow launching of deeper draft boats. There are no plans for this area.

6.) **Carlyle Sailing Association (CSA):** The public boat ramp is inoperable above 455 and the harbor is shut down. Above 452, cabin boats cannot be launched. The entrance road to Hazlet floods at 456. The jib crane launching facilities for CSA members is operable to 452.

1. The Corps constructed a 1,000 foot breakwater to 456 to protect harbor facilities in 1995. However, a 330-foot extension of the breakwater is needed to fully protect all the CSA facilities at high water. Cost of the breakwater is estimated at \$154,500 including contingencies.

2. The CSA has proposed constructing a high water ramp (elevation 455) on the proposed breakwater specifically to accommodate the cabin boats with large keels. Cost of the ramp and access road is estimated at \$131,000. Construction of this facility would be the responsibility of the CSA. An alternative would be to raise the boat ramp and parking lot to 454. Cost is estimated at 1.25 million dollars.

Recommendation: Construct a 330 foot breakwater and high water ramp to protect the shoreline, existing facilities and provide visitor safety.

7.) **Hitogi:** The ramp closes at 454.51. This ramp is not on the main lake. There are no plans to improve the ramp at this area.

8.) **North Fork:** The ramp closes at 453. This ramp is not on the main lake. There are no plans to improve the ramp at this area.

6. Evaluation Process: In general, the evaluation of alternatives was based on the study objectives and the results are shown in Table 6:

- a. Access road and ramp at 456 and above.
- b. Sufficient parking is available.
- c. Breakwater protection is present..
- d. Sufficient number of ramp lanes.
- e. Best location/geographically distributed..
- f. Benefit/cost ratio.

Table 6 – Evaluation of Boat Access Alternatives

Ramp	Access /Ramp at least 456	Sufficient Parking	Breakwater Protection	Ramp lanes sufficient/adequate	Best Location	BCR	Preferred Plan
Corps Areas							
Boulder							
Alt 1 Raise Main Ramp to 454	N	Y	Y	Y	Y	0.64	Alt 2
Alt 2 Improve existing highwater ramp	Y (460)	Y	N	Y	Y	1.14	
Alt 3 Raise Main Ramp to 460	Y	Y	Y	Y	Y	0.78	
Coles Creek							
Alt 1 Renovate highwater ramp	N (455)	Y	N	Y	Y	2.28	Alt 1
Alt 2 Raise main ramp and parking lot to 455	Y	Y	Y	Y	Y	1.03	
Dam East							
Alt 1 Construct high water ramp to NE corner of main ramp lot	Y	Y	N	N	Y	3.85	Alt 3
Alt 2 Raise Main Ramp to 460	Y	Y	N	Y	Y	1.94	
Alt 3 Add 2 lanes to high water ramp and useable at elevation 460	Y	Y	Y	Y	Y	2.31	
Dam West							
Alt 1 Raise Main Ramp to 460.	Y	Y	Y	Y	Y	2.49	Alt 2
Alt 2 Add traffic control and docking pier	y	Y	Y	N	Y	--	
Alt 3 Raise Main Ramp to 456.	Y	Y	Y	Y	Y	2.81	
Keyesport							
Alt 1 Raise Main Ramp apron to 455	N (455)	Y	Y	Y	Y	4.22	Alt 1
Alt 2 Raise ramp and parking lot to 457	Y	Y	Y	Y	Y	1.06	
Alt 3 Raise ramp and parking lot to 460	Y	Y	Y	Y	Y	0.77	
State Areas							
Deer Run							
Alt 1 Relocate ramp to cove entrance	Y	Y	N	Y	N	1.85	Alt. 1
Alt 2 Raise existing ramp to 452	N	Y	Y	N	N	0.8	

7. Comparison of Alternatives.

- a. Evaluation of alternatives, where available, will primarily be based on the reasonableness of cost, the recreation benefits maintained (the benefit cost ratio) and the potential for functionality
- b. Cost Estimate Summary and Economic Analysis – This cost estimate has been developed from general cost estimates prepared in the field. An appropriate contingency was applied to each estimate as shown in Table 7.

Table 7 – Comparison of Alternatives in Corps and State Areas

Boat Ramp	Alternative 1	Alternative 2	Alternative 3	Recommended Plan	Other	Other
Corps Areas						
Boulder	Raise main ramp to 454 and increase breakwater protection Cost:\$165,300	Replace ramp at 12% grade, – Cost: \$30,500 Add second high water ramp Cost: \$21,000	Raise main ramp and parking lot to 460 Cost:\$842,260	Alternative 2 & breakwater protection for main ramp	Add breakwater Cost: 90,000	Relocate campground Cost:\$87,900
Coles Creek	Correct high water ramp Cost:\$12,900	Raise ramp and parking lot to 455 Cost:\$688,867	N/A	Alternative 1		
Dam East	Construct new high water ramp in NE corner Cost:\$38,845	Raise main ramp to 460 Cost: \$231,230	Add 2 new ramps at 12% grade adjacent to high water ramp Cost:\$117,350	Alternative 3 & breakwater protection	Dam East High Water Breakwater Cost: \$122,198	Dam East Main Ramp Breakwater Cost: \$500K
Dam West	Raise main ramp and parking lot to 460 Cost:\$1,578,750	Raise dock pier to 456 and staff parking lot to monitor traffic. Cost:\$20,000	Raise ramp and parking lot to 456 Cost:\$1,087,125	Alternative 2		
Keyesport Main	Raise main ramp apron to 455. Cost:\$119,770	Raise parking area and ramp to 457 Cost:\$597,520	Raise ramp and parking lot to 460 Cost:\$978,615	Alternative 1		
Horseshoe Island	Rehab parking lot to accommodate more vehicles with trailers Cost:\$49,200			Alternative 1		

Boat Ramp	Alternative 1	Alternative 2	Alternative 3	Recommended Plan	Other	Other
Dam West Abutment:	Provide high water ramp from 450 to 472 Cost:\$16,610			Alternative 1		
State Areas						
Eldon Hazlet State Park Entrance Rd.	Raise entrance road to 460 or higher. Cost:Estimate: TBD			Further engineering study needed		
Apache High Water, IDNR	Add additional high water lane Cost:\$30,050			Alternative 1		
Allen Branch, IDNR	Rehab parking lot, ramp modifications, fish cleaning station Cost:1.1 million			Alternative 1		
Carlyle Sailing Assc.	Construct high water ramp (455) and access road if breakwater is completed. Cost: \$131,000	Raise parking lot and boat ramp to 456. Cost is estimated at 1.25 million		Alternative 1		Complete breakwater protection if justifiable – Cost: \$154,500
Deer Run	Move ramp to location on open water, if park loop road is completed Cost:\$90,766	Rehab ramp at same location and dredge mouth of inlet Cost:124,900		Alternative 1		

8. Benefits Evaluation: The unit-day value (UDV) method was used to evaluate the economic impacts of each alternative as specified in the National Economic Development (NED) benefit evaluation procedures, contained in ER 1105-2-100 (2000). The UDV, based on General Recreation for Carlyle Lake, was determined to be \$4.95 to \$10.69 as shown in Appendix 1. The UDV and the CY 2002 and 2004 visitation data were used to calculate the economic benefits gained, if the recreation facilities were constructed. The benefit cost ratio and the results of the analysis are shown in Table 8.

Table 8 Benefits Evaluation

Boat Ramp	Recom- mended Alternative	Average Annual Benefits Recreation	Annual- ized Cost	Benefit/Cost Ratio
Corps Areas				
Boulder	Alt. 2 & Breakwater	\$ \$3,415	\$	1.14
Coles Creek	Alt.1	\$1,707	\$749	2.28
Keyesport	Alt. 1	\$29,315	\$6,944	4.22
Dam West Abutment:	Alt 1.	\$1,156	\$963	1.20
Dam East	Alt 3 & Breakwater	\$15,750	\$6,804	2.31
Dam West	Alt. 2	N/A		
State Areas				
Eldon Hazlet State Park Entrance Rd.	Further study needed			
Apache High Water, IDNR	Alt. 1	\$2,553	\$1,742	1.47
Allen Branch	Construction scheduled			
Carlyle Sailing Assc.	Alt. 1	Not considered.		
Deer Run	Alt.1	\$9,752	\$5,263	1.85

9. Public Participation - Public meetings: Public involvement consisted of a master plan workshop/high water brainstorming session conducted on 27 February 2003 that included interested individuals and local business interests to discuss the options to keep the lake open during high water events. In addition, visitor comment cards and personal knowledge of the lake staff were used to identify issues related to high water events. One of the comments from that meeting included an expressed interest in ramps that are open to 475. However, having ramps that are functional to 455 (or higher where feasible) appeared to have the most consensus. All the comments from the meeting are provided in Appendix 2.
10. Conclusions, recommendations and approvals: Proposed actions for resolving the high water impacts have been addressed in this study. Generally ramps exist or can be made functional to 456 in a geographically balanced array around the lake. Ramps accessible to 460 would be available to 460 on each side of the lake: Boulder, and Eldon Hazlet. One ramp could be provided that would be accessible to 472 at Dam West. The recommendations of this study will be implemented through supplementation of the Carlyle Lake Master Plan.

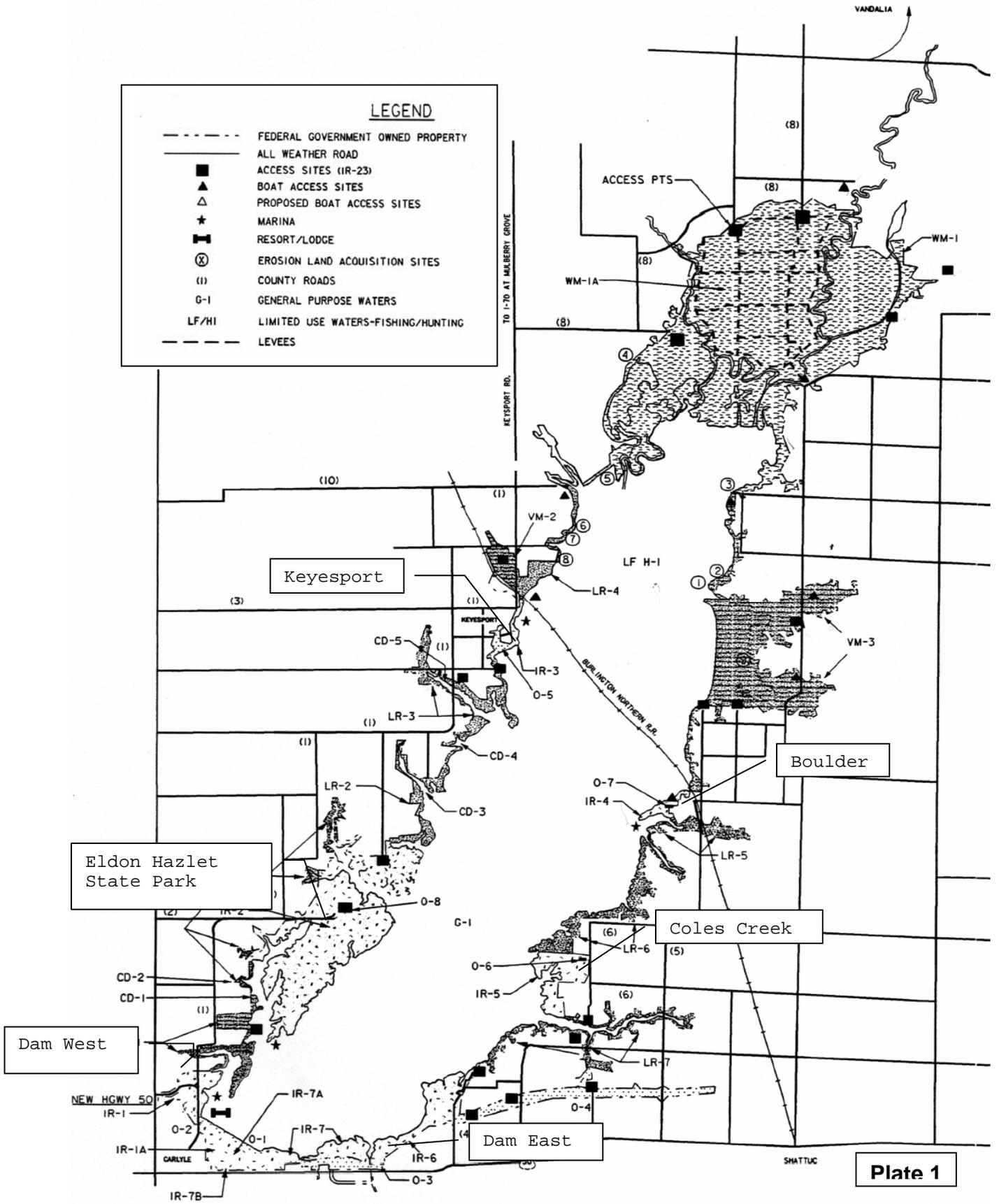
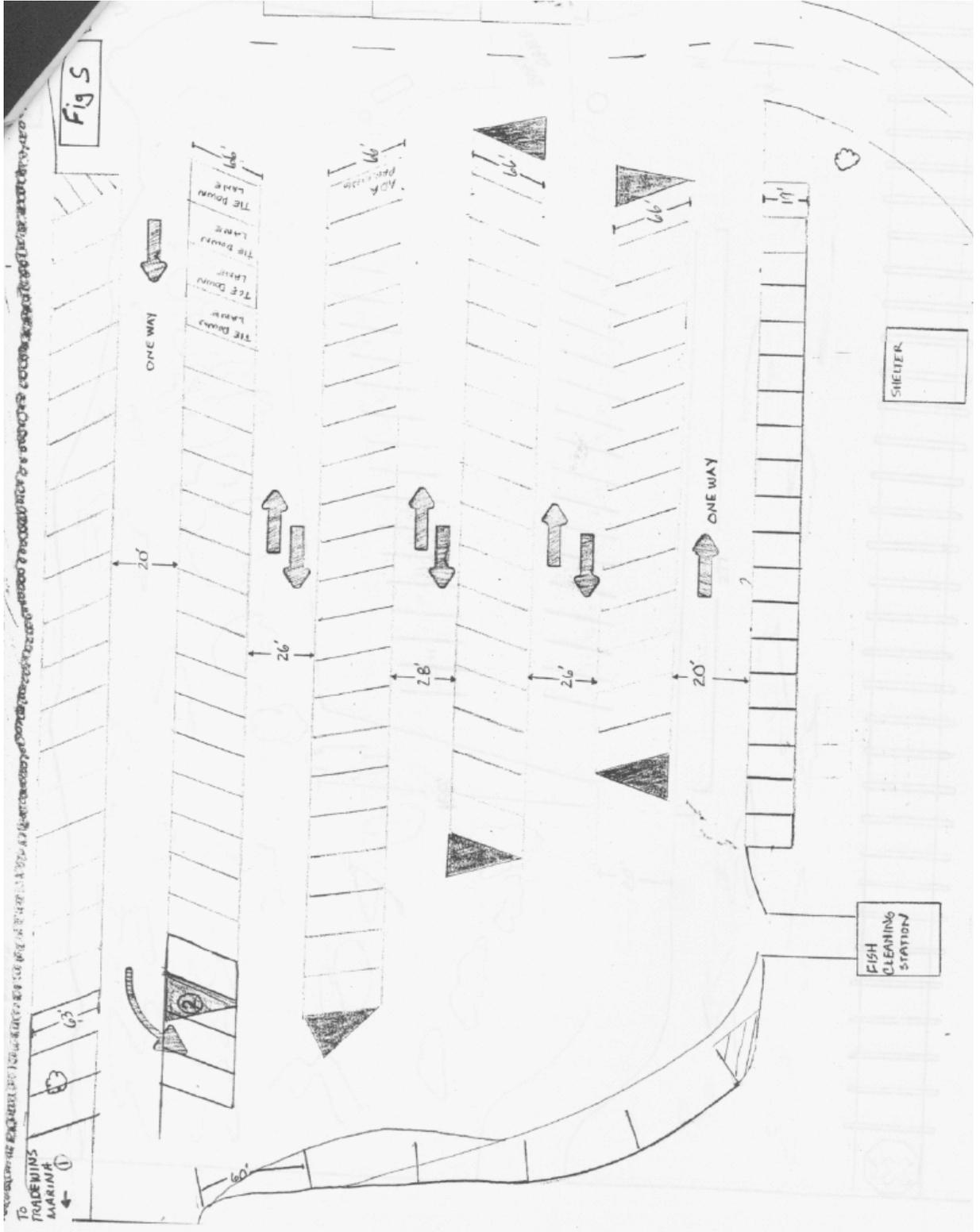


Plate 1

Plate 2 – Keysport Parking Plan



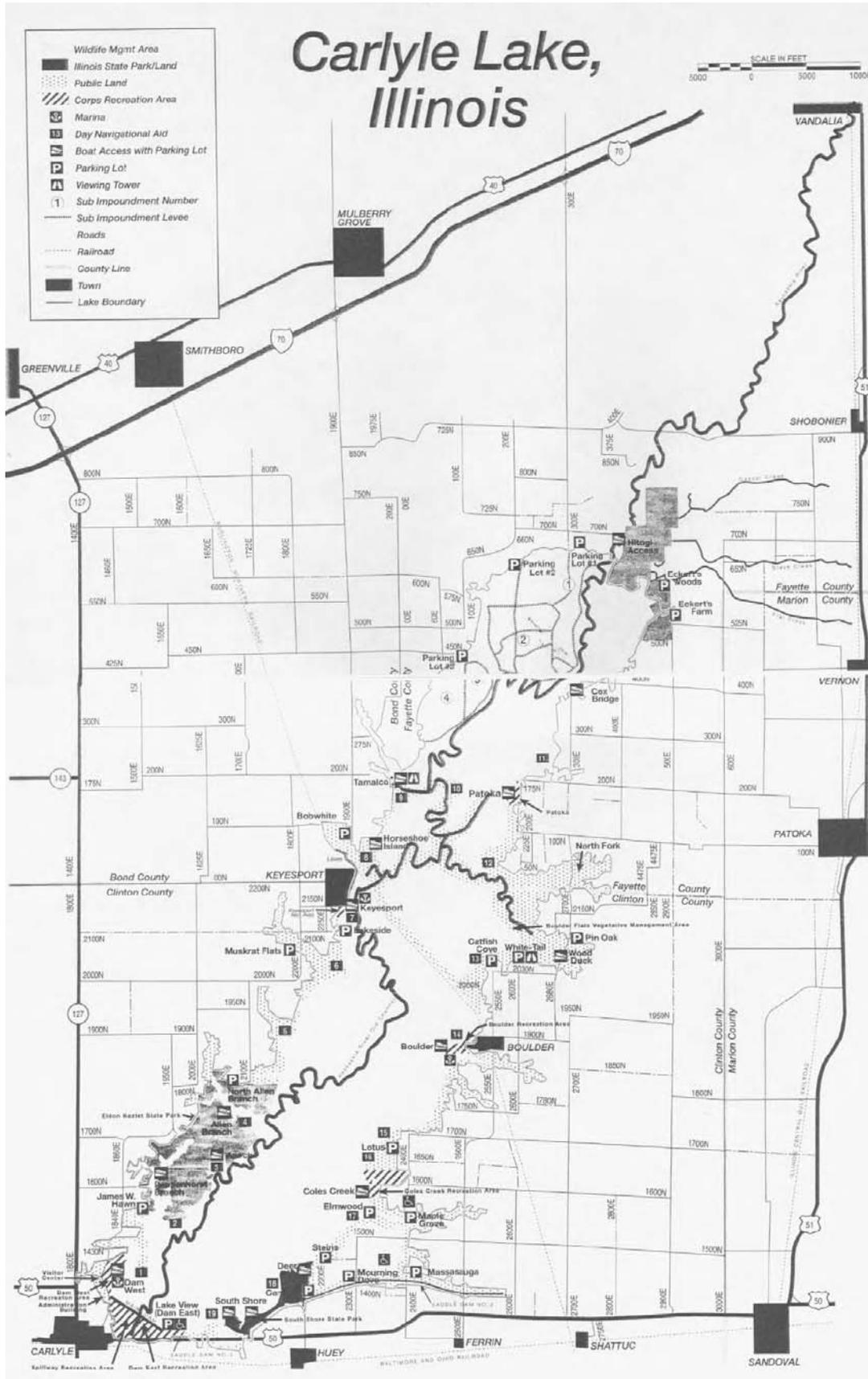


Plate 3

Appendix I

Carlyle Lake : High Water Impacts

01. Introduction

The objective of this study is to evaluate the National Economic Development (NED) feasibility of providing safe, continued access to high water ramps throughout Carlyle Lake as well as providing continued land access to land-based recreational facilities. In accordance with Engineering Regulation (ER) 1105-2-100, dated December 1990, an NED benefit-cost analysis is undertaken to assure that the value of the outputs produced (the NED benefits) by continued operation of recreational facilities at Carlyle Lake, Illinois exceeds the value of the inputs used (the NED cost).

Key economic assumptions employed in the NED evaluation of recreation facilities:

- (1) All benefits and costs are expressed in March 2005 price levels;
- (2) The CWCCIS is used for all necessary price level updates;
- (3) The project period of evaluation is estimated to be 50 years with appropriate operation and maintenance;
- (4) Project discount rate for the evaluation of NED benefits and costs is 5.375 percent;
- (5) Resources have alternative uses and, consequently, opportunity costs;
- (6) Individuals are risk neutral and rational economic agents;
- (7) All elevations are expressed in feet and are understood to represent "Ft., NGVD" (Feet, National Geodetic Vertical Datum).

02. Project Description

Carlyle Lake was authorized by the 75th Congress in the Flood Control Act of 1938. Carlyle Lake (hereafter, 'Lake') has become one of the prime destination spots for recreational activities, drawing approximately 4.5 million visitors annually. The Lake is a 26,000 acre reservoir located on the Kaskaskia River in Illinois at River Mile 94.2, with a drainage area of 2,717 miles. The Lake extends 13 miles upstream from the Kaskaskia Dam and has a surface area of 26,000 acres and 87 miles of shoreline at normal pool elevation (445.0 feet, NGVD). The Corps of Engineers operates eight intensively developed recreation areas while the State of Illinois operates three recreation areas. This study complements earlier studies describing the impact of high water on lake boat ramps and road access to land-based recreational facilities.

Key considerations employed in the economic evaluation of high water impacts and potential alternative solutions:

1. Most visitors will continue to use the Lake for recreation when lake levels are between elevations 450.0 and 456.0 feet. However, water levels begin to impact Lake recreational facilities at approximately elevation 450.0 ft.
2. Corps recreation facilities at the Lake effectively close at water elevations above elevation 456.0 ft.
3. Relocation of facilities, namely land-based facilities, is impractical due to rather limited high ground around the Lake.

4. Visitors primarily visit the Lake to recreate on the water, but require access to land-based support facilities (picnic sites, marinas, campsites, beaches, restrooms) that are usually not accessible at water elevations above elevation 455.0 ft.
5. Most Eldon Hazlet State Park camping and day use facilities are located at and above elevation 460.0 ft.; however, the lone access road to Hazlet State Park floods (becomes impassable) at elevation 456.4 ft.
6. Lake visitation loss due to high water events has significant economic impacts on local communities as well as counties within a 30-mile radius of the Lake.

Area runoff into the Lake has increased in the past 10 years. Programs implemented to reduce runoff into the Lake will require several years to become fully effective. The Lake continues its primary flood control mission of providing future downstream flood prevention on both the Kaskaskia and Mississippi Rivers in accordance with the Water Control Plan. Lake levels are higher more frequently and remain higher for longer in the past twenty years as compared to the previous twenty years, as shown in Table 1.

Table 1

Carlyle Lake Level Exceedance Durations in Total Days and Percent of Time

Lake Level (in feet)	1965-1984		1985-2004	
	Total Days	Percent of Time	Total Days	Percent of Time
>= 456.0	0	0.0	34	0.5
>= 455.0	26	0.4	49	0.7
>= 454.0	73	1.0	91	1.3
>= 453.0	128	1.8	161	2.2
>= 452.0	234	3.3	264	3.7
>= 451.0	415	5.9	403	5.6
>= 450.0	615	8.7	540	7.5

03. Economic Analysis

Recreation Benefit / Loss Methodology

Recreation benefits are generally defined as the sum of the maximum amount individuals are willing to pay to engage in a recreation activity, rather than forego the activity. This concept is referred to as “willingness-to-pay” and is the method recommended by the U.S. Water Resources Council as an appropriate economic measure of the benefits of outdoor recreation. Economic evaluation for this study is in accordance with guidelines specified in *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*, Washington D.C. (1983) United States Water Resources Council.

Recreational losses occur when flood conditions disrupt and/or eliminate normal visitation due to lost access to recreational facilities and/or inundated facilities. Recreational losses were generated for each recreation area by multiplying the reduced visitation resulting from inundated boat ramps and access roads by the recreational value of partaking in the activity. The elevation at each recreation area was derived and stage-percentage visitation reduction values by activity, under different flood frequency events were calculated. Also, the number of days the Lake pool would remain at each flood stage under different flood frequency events was computed. For each recreation area, the integration of flood frequency elevations and the duration of those elevations with stage-percentage visitation reduction values by recreational activity generated lost recreational days under both existing conditions and with project conditions.

The Unit Day Value approach is recommended for estimating the monetary value of benefits from recreation activities and any subsequent losses from the reduction of those recreation activities due to flooding. This approach is based on the willingness-to-pay of the user for the opportunity to recreate at a particular site. For example, if recreating at that site cost \$10.00, for some users the \$10.00 fee is the maximum they would be willing to pay. If the fee were raised, those users would choose to recreate elsewhere. However, many users would be willing to pay more than the \$10.00 fee to recreate at that site. Therefore, those users are in effect receiving additional benefits for which they do not pay. This concept is referred to as "consumer surplus." The Unit Day Value, in conjunction with the daily number of users, or visits to a particular site, determines the economic value of recreating at that site.

Benefits of recreating at a particular site are computed by quantifying the difference between the number of days a recreation site is accessible under the existing condition and the number of days that recreation site is accessible under the with project condition multiplied by the appropriate unit day value and the daily visitation rate at that site.

The Unit Day Values used are prepared by the Department of the Army, Directorate of Civil Works and published annually in an Economic Guidance Memo (EGM). For this report, EGM 05-05 (Fiscal Year 2005) is used. Unit Day Values, ranging from \$4.95 to \$10.69 per day, are presented in Table 2.

Table 2

Unit Day Values for Recreation, Fiscal Year 2005

Unit Day Values	
Activity	Value
Camping	\$5.16
Picnicking	\$4.95
Swimming	\$6.51
Hiking	\$7.72
Boating	\$10.69

Fishing	\$8.33
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Therefore, Unit Day Value benefits of recreating at a particular site are computed by quantifying the difference between the number of days a recreation site is available under the existing condition and the number of days that recreation site is available under the with project condition, multiplied by the appropriate unit day value and the daily visitation rate at that site.

In addition to the Unit Day Value benefits, there is an economic impact from foregone recreational spending. In Technical Report EL-95-16, *Economic Impact of Recreation on the Upper Mississippi River System*, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS (April 1995), spending by recreation users were surveyed within a 30-mile distance of recreation facilities. The report identified spending on two types of goods, consumable and durable. Durable spending consists of expenditures on goods such as boats, trailers, and camping gear. Such durable goods have an expected life of three or more years. On the other hand, consumable goods, such as food, gasoline, and articles of clothing, are depleted or discarded relatively soon. Services including hairdressing, movie theatres and medical care are also considered consumable goods.

For this study spending on only consumable goods will be considered. The report determined approximately \$14.12 (in 2005 dollars) per visitor per day is spent for consumable items. Foregone recreational consumer spending benefits are computed by quantifying the difference between the number of days a recreation site is available under the existing condition and the number of days that recreation site is available under the with project condition, multiplied by \$14.12 per visitor per day and the daily visitation rate at that site. Average annual benefits are the summation of generated unit day value benefits and foregone recreational consumer spending benefits.

Data Resources

Consultation with MVS District Office recreation specialists and Carlyle Lake managerial staff provided crucial data as well as valuable advice and insight for the study. Historical Lake visitation records (visits, visitor hours, visitor days), boat launch revenues, boat ramp closures were provided in daily, monthly and annual increments for all recreation areas evaluated. Also, historical Lake flood elevations and stage percent visitation reduction records by activity were accumulated for all recreation areas.

Several previous economic impact studies and supporting data were reviewed to assure accuracy of computation results of this study, including *Carlyle Lake Water Control Plan Deviation, Economic Impact Study* (November 1996).

Environmental Laboratory ERDC/EL TR-03-21, *Recreation Visitor Spending Profiles and Economic Benefit to Corps of Engineers Projects* (Recreation Management Support Program), U.S. Army Corps of Engineers, Engineer Research and Development Center (December 2003).

Bureau of Land Management (1987), *Recreation 2000*, Washington D.C.: U.S. Department of Interior, Bureau of Land Management.

Historical boat ramp closures, in total days, are presented from 1995-2004, for all recreation areas, in Table 3. Similar data was also provided for the recent flooding events and subsequent boat ramp / recreation area closings at Carlyle Lake in January and February of 2005.

Table 3

Unit Day Values for Recreation, Fiscal Year 2005

Boat Ramp Closed	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
State Areas										
IDNR Apache (Eldon)	66	60		10	9	27		64		7
Eldon Hazlet	66	60		10	9	27		64		7
IDNR Peppenhorst	66	60		10	9	27		64		7
IDNR Allen Branch	63	53			8	24		64		4
Deer Run	29	3						48		
Cox Bridge	13							25		
Carlyle Sailing Assoc.	12							23		
Corps Areas										
Dam West Main Ramp	29	41			5	13		57		1
Boulder Main Ramp	29	41			5	13		57		
Coles Creek Main Ramp	29	41			5	13		57		
Dam East Main Ramp	29	41			5	13		57		
Wood Duck	29	3						48		
Keyesport Main Ramp	28							30		
Tamalco	28							30		
Patoka	28							30		
North Fork	28							30		
Dam West High Water								20		
Coles Creek High Water	12							20		
Dam East High Water	12							20		

Corps Areas

Boulder Recreation Area

The Boulder 4-lane main boat ramp elevation is 450.0 ft. and the 1-lane high water boat ramp elevation is 460.0 ft. There are usage problems with the main ramp due to wave action from the North and Northwest. The main ramp becomes inundated at 450.0 ft., leaving only the 1-lane high water ramp available. The break-over angle at the top of the high water ramp results in insufficient clearance for vehicles/trailers.

Four alternatives have been identified:

Alternative 1 : Raise the main ramp to 454.0 ft. The cost for Alternative 1, including contingencies, is \$165,300. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$9,584. Average annual benefits are estimated at \$32,252, generating net benefits of \$22,668 and a benefit-cost ratio (BCR) of 3.37.

Alternative 2a : Rehab the 1-lane high water ramp to correct the design problem, leaving the high water ramp at 460.0 ft. The cost for Alternative 2a, including contingencies, is \$30,500. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$1,768. Average annual benefits are estimated at \$1,138, generating net benefits of *negative* \$630 and a BCR of 0.64.

Alternative 2b : Add an additional (second) lane to the 1-lane high water ramp to increase Lake access under high water conditions. The cost for Alternative 2b, including contingencies, is \$51,500. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$2,986. Average annual benefits are estimated at \$3,415, generating net benefits of \$429 and a BCR of 1.14.

Alternative 3 : Raise the main ramp and boat ramp parking lot to 460.0 ft. Parking and all four lanes of the main ramp would be accessible to a lake level of 460.0 ft. The cost for Alternative 3, including contingencies, is \$842,260. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$48,835. Average annual benefits are estimated at \$37,943, generating net benefits of *negative* \$10,892 and a BCR of 0.78.

Coles Creek Recreation Area

The Coles Creek 4-lane main boat ramp elevation is 450.0 ft. and the 1-lane high water boat ramp elevation is 456.0 ft. The high water ramp has break-over angle design problems similar to the Boulder high water ramp. The parking lot elevation rises on a consistent slope from 450.0 to 456.0 ft. The entrance road to the ramps floods (becomes impassable) at 456.0 ft. Therefore, no Alternatives with elevations higher than 456.0 are proposed.

Two alternatives have been identified:

Alternative 1 : Rehab the 1-lane high water ramp to correct the design problem, leaving the high water ramp elevation at 456.0 ft. The cost for Alternative 1, including contingencies, is \$12,900. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$749. Average annual benefits are estimated at \$1,707, generating net benefits of \$958 and a BCR of 2.28.

Alternative 2: Raise the main ramp and boat ramp parking lot to 455.0 ft. Parking and all four lanes of the main ramp would be accessible to a lake level of 455.0 ft. The cost for Alternative 2, including contingencies, is \$688,870. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$39,941. Average annual benefits are estimated at \$40,961, generating net benefits of \$1,020 and a BCR of 1.03.

Dam East Recreation Area

The Dam East 4-lane main boat ramp elevation is 451.0 ft. and the 2-lane high water boat ramp elevation is 456.0 ft. The slope on the high ramp makes it difficult to use and there is limited parking in the immediate area.

Three alternatives have been identified:

Alternative 1: Relocate the ramp to the northeast corner of the Dam East main ramp parking lot and install new breakwater protection. The cost for relocating the ramp, including contingencies, is \$38,845. The cost for installing new breakwater protection, including contingencies, is \$500,000. The total cost for Alternative 1, including contingencies, is \$538,845. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$31,243. Average annual benefits are estimated at \$9,334, generating net benefits of *negative* \$21,909 and a BCR of 0.30.

Alternative 1 (without breakwater): Relocate the ramp to the northeast corner of the Dam East main ramp parking lot. The cost for Alternative 1, including contingencies, is \$38,845. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$2,252. Average annual benefits are estimated at \$8,680, generating net benefits of \$6,428 and a BCR of 3.85.

Alternative 2: Raise the main ramp and boat ramp parking lot to 460.0 ft. Parking and all four lanes of the main ramp would be accessible to a lake level of 460.0 ft. The cost for raising the ramp and parking lot, including contingencies, is \$231,230. The cost for installing new breakwater protection, including contingencies, is \$500,000. The total cost for Alternative 2, including contingencies, is \$731,230. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$42,397. Average annual benefits are estimated at \$28,000, generating net benefits of *negative* \$14,397 and a BCR of 0.66.

Alternative 2 (without breakwater): Raise the main ramp and boat ramp parking lot to 460.0 ft. Parking and all four lanes of the main ramp would be accessible to a lake level of 460.0 ft. The cost for Alternative 2, including contingencies, is \$231,230. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$13,407. Average annual benefits are estimated at \$26,040, generating net benefits of \$12,633 and a BCR of 1.94.

Alternative 3: Rehab the 2-lane high water ramp by excavating the adjacent slope to the southeast and adding two additional ramps. This would result in a 4-lane high water ramp, significantly increasing Lake access under high water conditions. Sufficient parking for increased traffic is available at the Dam East main parking lot. The cost for Alternative 3, including contingencies, is \$117,350. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$6,804. Average annual benefits are estimated at \$15,750, generating net benefits of \$8,946 and a BCR of 2.31.

Dam West Recreation Area

The Dam West 4-lane main boat ramp elevation is 451.0 ft. and the 1-lane high water boat ramp elevation is 456.0 ft. Recently, the breakwater protection was improved by raising it and extending it to the northeast. Raising the ramp to 460.0 ft. would provide more parking during high water events.

Two alternatives have been identified:

Alternative 1: Raise the main ramp and boat ramp parking lot to 456.0 ft. Parking and all four lanes of the main ramp would be accessible to a lake level of 456.0 ft. The cost for Alternative 1, including contingencies, is \$1,087,125. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$63,032. Average annual benefits are estimated at \$177,014, generating net benefits of \$113,982 and a BCR of 2.81.

Alternative 2: Raise the main ramp and boat ramp parking lot to 460.0 ft. Parking and all four lanes of the main ramp would be accessible to a lake level of 460.0 ft. The cost for Alternative 2, including contingencies, is \$1,578,750. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$91,537. Average annual benefits are estimated at \$227,593, generating net benefits of \$136,053 and a BCR of 2.49.

Keyesport Recreation Area

The Keyesport 4-lane main boat ramp elevation is 453.0 ft. Fishing tournaments departing from the Keyesport Recreation Area generates a large demand for parking.

Three alternatives have been identified:

Alternative 1: Raise the main ramp apron to 455.0 ft. The cost for Alternative 1, including contingencies, is \$119,770. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$6,944. Average annual benefits are estimated at \$29,315, generating net benefits of \$22,371 and a BCR of 4.22.

Alternative 2: Raise the main ramp and boat ramp parking lot to 457.0 ft. Parking and all four lanes of the main ramp would be accessible to a lake level of 457.0 ft. The cost for Alternative 2, including contingencies, is \$597,520. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$34,645. Average annual benefits are estimated at \$36,645, generating net benefits of \$2,000 and a BCR of 1.06.

Alternative 3: Raise the main ramp and boat ramp parking lot to 460.0 ft. Parking and all four lanes of the main ramp would be accessible to a lake level of 460.0 ft. The cost for Alternative 2, including contingencies, is \$978,615. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$56,741. Average annual benefits are estimated at \$43,972, generating net benefits of *negative* \$12,769 and a BCR of 0.77.

Dam West Recreation Area - West Abutment

The West Abutment boat ramp is 450.0 ft. Limited parking is available.

One alternative has been identified:

Alternative 1: Construct a new ramp at the west abutment to the dam. The ramp, raised from 450.0 ft. to 475.0 ft, could be placed in the dry and opened when lake levels reach 456.0 ft. The cost for Alternative 1, including contingencies, is \$16,610. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$963. Average annual benefits are estimated at \$1,156, generating net benefits of \$193 and a BCR of 1.20.

State Areas

Eldon Hazlet State Park

Entrance Road. Eldon Hazlet State Park has recreation facilities located at and above elevation 460.0 ft., yet the entrance roadway to the Hazlet Park facilities floods (becomes

impassable) at elevation 456.4 ft. Therefore, raising the entrance road would provide continued access to Hazlet Park recreation facilities under high water conditions.

Two alternatives have been identified:

Alternative 1: Raise the entrance road to 460.0 ft. Hazlet Park facilities would be accessible to a lake level of 460.0 ft. The cost for Alternative 1, including contingencies, is \$1,161,175. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$67,326. Average annual benefits are estimated at \$80,146, generating net benefits of \$12,821 and a BCR of 1.19.

Alternative 2: Raise the entrance road to 462.5 ft. Hazlet Park camping and day use facilities would be accessible to a lake level of 460.0 ft., and Hazlet Park facilities at elevation 462.5 ft. or higher would be accessible to a lake level of 462.5 ft. The cost for Alternative 2, including contingencies, is \$1,632,220. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$94,637. Average annual benefits are estimated at \$83,486, generating net benefits of *negative* \$11,151 and a BCR of 0.88.

Apache Ramp. The Hazlet Apache 2-lane main boat ramp elevation is 450.0 ft. A separate 1-lane high water boat ramp adjacent to the main ramp is at elevation 459.9 ft. As noted above, the entrance roadway to the Hazlet Park facilities floods (becomes impassable) at elevation 456.4 ft.

One alternative has been identified:

Alternative 1: If the Hazlet Park entrance road is raised to 460.0 ft., an additional lane would be added to the 1-lane high water ramp, increasing Lake access under high water conditions. The cost for Alternative 1, including contingencies, is \$30,050. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$1,742. Average annual benefits are estimated at \$2,553, generating net benefits of \$811 and a BCR of 1.47.

Allen Branch Recreation Area

The Allen Branch 4-lane main boat ramp elevation is 450.5 ft.

Two alternatives have been identified:

Alternative 1: A general upgrade including resurfacing of parking lots, ramp modifications, and a more accessible boat ramp. The cost for Alternative 1, including contingencies, is \$340,200. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$19,725. Average annual benefits are estimated at \$6,412, generating net benefits of *negative* \$13,313 and a BCR of 0.33.

Alternative 2: Raise the main ramp, boat ramp parking lot and entrance road to 452.0 ft. Parking, all four lanes of the main ramp and the entrance road would be accessible to a lake level of 452.0 ft. The cost for Alternative 2, including contingencies, is \$593,185. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$34,390. Average annual benefits are estimated at \$15,390, generating net benefits of *negative* \$19,000 and a BCR of 0.45.

Deer Run Recreation Area

Located on a small inlet on the east end of South Shore State Park, the 1-lane main (and only) boat ramp has three problems: the channel to open water becomes silted in at the Lake entrance; the ramp is at elevation 447.0 ft.; and the entrance road floods (becomes impassable) at elevation 452.0 ft. Proposals include relocating the ramp to higher ground with direct water access or dredging out the boat channel.

Two alternatives have been identified:

Alternative 1: Relocate the ramp to the mouth of the inlet, a higher ground elevation of 456.0 ft., *when* the South Shore State Park loop road development is implemented. The cost for Alternative 1, including contingencies, is \$90,770. Average annual cost, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$5,263. Average annual benefits are estimated at \$9,752, generating net benefits of \$4,489 and a BCR of 1.85.

Alternative 2: Raise the ramp to 452.0 ft. and dredge out the mouth of the inlet every three years. The cost for raising the ramp, including contingencies, is \$25,500. The cost for dredging the inlet mouth to a depth of 6.0 ft. is \$124,720, and dredging would be performed every three years. Combined average annual costs for both raising the ramp and dredging, realizing a project evaluation period of 50 years and a 5.375% discount rate, is estimated at \$1,479 and \$43,944, respectively, totaling \$45,423. Average annual benefits are estimated at \$3,706, generating net benefits of *negative* \$41,717 and a BCR of 0.08.

**Appendix 2 - Master Plan Brainstorming Session
Master Plan Supplement Brainstorming Meeting
February 27, 2003**

1. LAND BASED ACCESS

- Raise Hazlet road only after all other ramps are raised
- Want high water ramps to 475 NGVD
- No “Closed” signs during high water
- Flowage easements — need to be concerned for residents/property
- Raise 2.2 miles of Hazlet road — road closes at 456 (Park Closed)
- Raise CSA area/facilities — closes at 449.5 — Need to raise CSA lot to 455
- Facilities to 450 is not good enough
- Need to capitalize or develop of high elevation areas on east side of lake (i.e. South Shore)
- Rehab road at South Shore in 2 years (IDNR programmed)
- IDNR programming
 - Allen Branch boat ramp upgrade (only minimal raise)
 - Deer Run Peppenhorst Branch Boat Ramp’s — scoping to make improvements
 - Apache — resurfacing this spring
- City of Carlyle sewer lagoons need flood protection
- All facilities need to be upgraded to be more user friendly during high use
- Facilities need to be well designed/constructed to 455
- Need to improve existing facilities before we build more (esp. beyond 455)
- Need to focus on all facilities/areas at the Lake—Not just Dam West
- Need to make improvements beyond 455-456
- Need to raise portions of the beaches
- Need to maximize economic conditions and use of the lake at least to 455 (i.e. from 445-455)
- The Federal government owes improvements at Carlyle to the public because it is not functioning as designed
- CSA needs high water launching more that other areas from 455 and below

2. WATER BASED ACCESS

- Ramps to 475
 - 2 lane boat ramp — each corner of the dam
 - Boulder Access — high water ramp extended to road
 - Concrete platform CSA to launch at high levels
 - Keyesport — boat ramp at beach
 - South Shore State Park — Hickory Hollow Campground — high water ramp
- Not using word “Closed”
- High Water Ramp CSA — Raise CSA facilities/parking lots
- Allen Branch — extra lane/floating docks