

**ANOKA, MINNESOTA  
RUM RIVER DAM  
PRELIMINARY ASSESSMENT  
SMALL RECREATIONAL CRAFT  
NAVIGATION LOCK**

**July, 1993**

**by**

**Peter A. Fischer P.E.  
Consulting Civil Engineer**

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

  
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Peter A. Fischer P.E.

Registration No. 5986 Date: 7/16/93

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July 16, 1993

Mr. Mark Nagel  
City Manager  
City Hall  
2015 First Avenue  
Anoka, Minnesota, 55303

Dear Mr. Nagel:

As required by the May 5, 1993 agreement and its attached scope of work for the preliminary assessment of a small recreational craft navigation lock at the Rum River dam in Anoka, Minnesota, I am furnishing 10 copies of the completed final report for your consideration.

The report discusses the conceptual design for converting the existing spillway stilling basin to a small boat lock, alternatives to a lock and costs for the lock and alternatives. The report discusses a number of important issues related to lock development. The report also evaluates a pedestrian bridge at the dam, placing permanent crest gates on the overflow section of the dam and impacts of alterations to the Coon Rapids dam on the Mississippi River.

I would be pleased to review this report with you in detail at your convenience. I am also prepared to present report results to the Anoka City Council at a date convenient to you.

1 Enclosure:  
Report (10 copies)

Sincerely,



Peter A. Fischer, P.E.  
Consulting Civil Engineer

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**EXECUTIVE SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS**

**Objective and Scope.-**

The primary purpose and scope of the preliminary assessment and this report are to investigate the issues and costs associated with the development of a small recreational craft navigation lock at the Rum River dam on the Rum River in Anoka, Minnesota. Included in the study is a preliminary evaluation of alternatives to a navigation lock.

**Conclusions.-**

1. The Rum River and its drainage area supply adequate run-off, flows and levels to permit development of a small recreational craft navigation system on the river from its confluence at the Mississippi River for a distance of about 6 to 8 miles upstream.
2. The Rum River dam increases river levels for a distance of about 7 miles above the dam.
3. The site of the Rum River dam is constricted but adequate for a small boat lock or other boat transfer facility.
4. No known structural conditions at the dam or its foundation would prevent construction of a small boat lock at the dam.
5. A navigation system could be developed on the river and at the dam to accommodate small boats from canoe size up to and including pontoon boats, runabouts and small cruisers requiring a maximum water depth clearance (draft) of 3.5 feet.
6. Minimum lock dimensions would be 20 feet wide by 54 feet long with 4.0 feet clear draft. Transit time would average 30 minutes and vary between 15 and 45 minutes.
7. The existing spillway and stilling basin at the dam could be converted to a small boat lock for a cost of about \$3,000,000.

8. Possible alternatives to a lock include a motorized portage costing \$150,000 and a mechanical lift system costing \$450,000.

9. Only moderate excavation and dredging to the river channel downstream and upstream from the dam would be required to develop a recommended navigation water depth (draft) of 3.5 feet. The 3.5 feet of draft may not be maintained naturally by the river downstream from the dam. Thus, the river may need some periodic dredging to maintain a 3.5-foot depth.

10. A lock or other boat transfer facility may alter the existing character of the river and add to the possibility of the introduction of undesirable species.

11. Permanent automatic crest gates costing \$1,100,000 may have merit as an independent undertaking or in support of a lock development.

12. A new pedestrian bridge located immediately downstream from the dam and costing about \$680,000 may have merit as an independent undertaking or as a supplement to lock development.

13. Costs of operation, preventive maintenance and future repair and replacement may be substantial and need to be considered.

14. Construction of a lock at the dam would pose some added hazard, risk and liability to the City of Anoka.

15. Should the City of Anoka determine that it is in its interest to continue toward lock development, the process should be phased a step at a time starting with a market analysis, next a detailed financial analysis, followed by a detailed feasibility study.

16. Modifications to operation of the Coon Rapids dam may have adverse impacts on the Mississippi and Rum Rivers in the City of Anoka and on the feasibility of developing a small boat navigation system at the Rum River dam.

17. Further investigation of the installation of flow splitters to eliminate the pulsations at the dam may have merit.

18. Agency review and permit processing including an EAW and resolution of appropriateness concerning the Wild and Scenic River designation could add significant issues and time to any project completion schedule.

**Recommendations.-**

1. Should the City of Anoka determine that it is in its interest to consider further development of a lock costing up to about \$3,000,000, or a mechanical lift or marine railway costing about \$450,000, it is recommended that a market analysis of desirability, acceptability, demand, need, use and willingness to pay be undertaken prior to investing substantial funds in a detailed feasibility study.

2. Secondly, prior to undertaking a detailed feasibility study, the impact of the Minnesota Wild and Scenic Rivers Act and the designation of the Rum River as a Wild and Scenic River needs examination. The question would be: Is added boating traffic as encouraged by a lock in keeping with the intent of the Wild and Scenic Rivers designation?

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SMALL RECREATIONAL CRAFT NAVIGATION LOCK**

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**ANOKA, MINNESOTA**  
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**1.0 AUTHORITY. -**

The Anoka City Council authorized this report and the preliminary assessment of a small recreational craft navigation lock at the Rum River dam at its meeting of April 19, 1993. The City Manager issued a letter agreement and scope of work on May 5, 1993.

**2.0 SCOPE AND PURPOSE. -**

The primary purpose and scope of the preliminary assessment and this report are to investigate the issues and costs associated with the development of a small recreational craft navigation lock at the Rum River dam on the Rum River in Anoka, Minnesota. Included in the study are a preliminary evaluation of alternatives to a navigation lock. The assessment and report have been expanded as directed in the letter agreement to evaluate the replacement of the fixed flash boards with movable and permanent crest gates on the dam, a pedestrian bridge at the dam, comment on possible reasons for the pulsation at the Rum River dam, and to evaluate impacts at Anoka of the dam removal or permanent pool lowering at the Coon Rapids Dam on the Mississippi River as developed in a master management plan developed for the Suburban Hennepin Regional Park District.

As this report is the result of a preliminary assessment, all issues and information are to be considered to be a pre-feasibility scope for budgeting purposes and for Anoka City Council use in further evaluation of the desirability of continuing a study into the feasibility and detailed engineering phases of a project. The information in this report is adequate for these stated purposes, but should be refined and further confirmed in detailed feasibility studies should the Anoka City Council decide to carry a project forward.

**3.0 BACKGROUND. -**

Meetings were held with the City Manager, the Public Works Director and interested individuals on March 23, 1993 and April 23, 1993 to discuss the scope of work and objective of a study. The dam site and spillway were viewed, and a reconnaissance of the Rum River upstream and downstream from the dam was conducted on March 23, April 23, May 4 and May 5. The project was also discussed in some detail with the Public Works Director during these site visits.

A substantial volume of data and information on the river and dam, including flow data and as-built construction drawings for the dam were obtained and reviewed as part of the preliminary assessment. Appendix A attached to this report lists the information reviewed and evaluated to develop

findings and recommendations. A list of contacts and discussions with other officials and interested parties together with the subject of discussions is included as Appendix B.

#### **4.0 RUM RIVER BASIN. -**

This section discusses the hydrologic and hydraulic regime of the Rum River. It includes information which is significant when considering the development of small recreational craft navigation on the River and a lock at the dam.

The Rum River drainage basin of approximately 1,550 square miles is located in east central Minnesota. Its source is in Mille Lacs Lake at about elevation 1250. It flows a distance of about 145 miles before emptying into the Mississippi River at about elevation 832 in the city of Anoka. The narrow basin is about 90 miles long and averages about 17 miles wide. Average river slope is about 8.0 feet per mile between Onamia and Milaca, but only about 1.5 feet per mile from about Princeton to Anoka. The Coon Rapids dam on the Mississippi River and the Rum River dam near mile 1 create a nearly flat pool in the lower 8 miles of the river. Drop across the Rum River dam varies from about 9 feet in the winter to about 13 feet in the summer.

The lower 8 miles of the river average from about 150 feet wide to over 300 feet wide in the pool, and have natural depths from 2 to 3 feet. The normal depth of the pool behind the Rum River dam varies from about 13 feet at the dam to 4 feet at mile 5 and 3 feet at mile 6. The normal river elevation at the bridge on Anoka County Road No. 7 at about river mile 10 is about elevation 848 to 849, or 3 to 4 feet above the pool of the Rum River dam at about elevation 845.

Average discharge of the river was about 560 cubic feet per second (cfs) from 1930 to the present. Maximum discharge was 10,100 cfs on April 20, 1965 and April 13, 1969. Minimum was 29 cfs on August 18, 1934. River discharge exceeds 100 cfs about 90 percent of the time. Approximate mean discharge for December, January and February is about 200 cfs; March, April and May about 1,000 cfs; June, July and August about 500 cfs; and September, October and November about 300 cfs. Discharge is recorded at a USGS gage near St. Francis, Minnesota. Thus, discharge at the Rum River dam could be expected to be slightly larger than those listed. All elevations are listed in National Geodetic Vertical datum (NGVD) 1929 adjustment.

#### **5.0 RUM RIVER DAM. -**

The Rum River dam is located on the Rum River approximately 4,000 feet upstream from the river's confluence with the Mississippi River in the city of Anoka, Minnesota. The dam was constructed in 1969 to replace an earlier dam constructed in 1854. The dam consists of a vertical reinforced concrete westerly abutment, a sloping front face of reinforced concrete and buttress supported fixed crest overflow section approximately 236 feet long and 9 feet high, a 20-foot wide by 236-foot long upstream apron, and a Tainter gated spillway and stilling basin 30 feet wide by 150 feet long at the easterly shoreline. At the easterly shoreline the gated spillway connects to the abutments and walls of an earlier dam. During the summer season, fixed wooden flash boards approximately 2.9 feet

high are placed on the 236-foot long overflow section. Downstream from the overflow section a 36-foot long by 236-foot wide reinforced concrete flat slab stilling basin with baffle blocks and end sill dissipates the energy of falling water and prevents scour downstream from the dam. The Tainter gate in the spillway is moved by two chains connected to an electric motor driven hoist. Seepage under the dam is controlled by two rows of steel sheet pile cut-off wall across the entire dam, one at the upstream end and one at the downstream end of the upstream apron. The west abutment is founded on piling, but the main dam and spillway are founded on a high density compacted granular backfill base. A 30-foot ribbon of stone riprap is located across the river on the downstream side of the dam. The dam contains a piping system for foundation drainage. The dam is shown in the plan view and plan section views on sketches 1 and 2 at the end of the report ahead of the appendices.

## **6.0 NAVIGATION CONSIDERATIONS. -**

6.1 Analysis of Desirability. - Because a recreational boating facility such as a lock is a discretionary undertaking of a public body as opposed to a mandatory item such as street maintenance or public safety, the public governing body must carefully consider the public's perception of need, demand, acceptability, desirability, use and willingness to pay for the service. An analysis of desirability (market analysis using the normal commercial market term) should be finished prior to any decision to invest substantial funds in detailed studies of engineering feasibility. This market analysis would be one of the first steps in a detailed feasibility study.

Although a detailed analysis of desirability is beyond the scope of this preliminary assessment, some information is readily available for use in a market analysis. The 1990 census population of the six cities surrounding the lower Rum River and the pool created by the Coon Rapids dam is substantial (over 119,000), composed of Anoka (17,192), Champlin (16,849), Andover (15,216), Ramsey (12,408), Coon Rapids (52,978) and Dayton (4,443). The areas of Ramsey and Andover adjacent to the Rum River are experiencing rapid residential development and may contribute a substantial base of use for a lock at the Rum River dam. The city boat launching ramp in the Anoka city park downstream from the Rum River dam had about 270 fee-paying (\$3.00) users in its first partial year of operation. Somewhat farther away and not directly comparable, the St. Anthony Falls Lock and Dam on the Mississippi River near the Third Avenue Bridge in Minneapolis had lockages of 3,355 recreation craft in 1992.

The Canoe Route Maps published by the Minnesota Department of Natural Resources show a number of boat launching sites on the lower Rum River and the Mississippi River in the general vicinity. These are located at Dayton, Champlin and above Coon Rapids dam on the Mississippi River; Anoka Riverside Park, Rum River South County Park, Isanti, and Walbo Ferry Landing near Cambridge on the Rum River; a total of 7.

A detailed analysis would more accurately determine public acceptability and potential use. The analysis would include surveys of boaters on the Rum River and Coon Rapids pool, door-to-door surveys of those living close to the river, public mailings, public meetings, questionnaires on willingness to pay, and information from boat registrations in addition to the normal market analysis tools.

6.2 Craft Size and Type. - Table II at the end of the report ahead of the sketches lists the characteristics and dimensions of the various types of recreational boats that may use a lock or other boat transfer facility on the lower Rum River. The possible range of boats that may use the river varies from canoes to fishing boats, pontoons, runabouts and small cruisers.

6.3 Desirable Draft. - An examination of table II at the end of this report shows that the draft requirements vary from a minimum of 6 inches for a canoe to 23 inches for a small cruiser either without motors or with propellers fully retracted. Adding motors or extending propellers increases the minimum draft requirements to 20 inches and 40 inches respectively. The desirable minimum draft for a soft bottom channel would be about 3.5 feet and for fixed concrete structures about 4.0 feet to allow for clearance. The evaluation for this report indicates that the Rum River from its confluence with the Mississippi up to the Rum River dam may not be able to support a depth of over about 3 feet naturally without periodic dredging at selected locations. This item would require careful detailed study in a feasibility report.

6.4 Transit Time. - Transit time relates to the public's willingness to wait for service. When one is in a drive-up teller line or a fast food service line, waits longer than 10 minutes may lead to outcry and abandonment of the line for service elsewhere. When one waits in line at a recreation event such as a line-up of boats at a lock, the allowable wait time is related to the length of the recreation experience. Most boaters probably would wait 30 minutes for a 4-hour boat trip or 2-30 minute periods for a 6-hour experience. Should waits exceed these times, the boaters would likely seek a trip that requires no wait, or a lesser wait. Thus, the transit time through a recreational boat lock will directly affect the desirability of the lock and its ultimate use. For this preliminary assessment transit time is set at 15 minutes as most desirable and 30 minutes as the maximum. These times will establish the minimum desirable size of the lock chamber.

6.5 Navigation Season. - The primary small boat navigation season at the Rum River dam is expected to coincide with the normal spring fishing season and summer boating season in Minnesota of from about 15 May to 30 October each year. For this evaluation the navigation season is considered to be the time that the headwater pools at the Coon Rapids dam and the Rum River dam are at the elevated summer levels; that is, about the first week in May to the last week in October. All water levels for required navigation draft are related to these summer levels as the minimum navigation levels (headwater elevation 830.1 at Coon Rapids dam and 844.24 at Rum River dam in NGVD elevation 1929 adjustment).

This study considered lock availability for boat passage on either a full time, 24-hour, 7-days a week basis or a more limited basis; such as, 10 hours a day, 5 days a week including week ends and holidays, but excluding Mondays and Tuesdays. Normally, Mondays and Tuesdays are light boating days. For example, operating hours could be from 9:00 a.m. to 7:00 p.m. Hours and days of operation could be expanded as demand increases. Full time operation was not considered feasible for initial operation. As operation schedules could be published, overnight and transient docking for those

missing operational times was considered beyond the normal services provided for initial operation. A reservation system for an added fee may be possible for those needing after hour service. Overnight docking provided by a private concessionaire is a possibility, but was not evaluated in this study. This overall subject would be part of a detailed market analysis.

6.6 Water Supply for Lock. - Filling the lock requires a supply of water from the pool upstream from the dam. The greatest rate of supply would be required for a project that converts the existing spillway stilling basin into a lock. The portage, marine railway and mechanical lift systems do not require a water supply.

The lock would require a maximum average supply of 67.5 cfs to fill in an average of 8 minutes. Peak supply rate may be about 130 cfs. The continuous maximum average supply for constant and continuous operation would be 34 cfs. Since Rum River discharge exceeds 100 cfs at the St. Francis recording station over 90 percent of the time, the natural river supply is more than adequate. Seldom and only during severe drought would the river supply restrict lock operation. Then, a slight pool draw down would be required to meet the peak supply demand.

6.7 Discussion. - Considering navigation requirements and boat characteristics detailed in this section of the report the following criteria are established for any facility developed at the Rum River dam to transfer boats from one level to the other:

- Maximum boat size: Pontoon controls - 8 feet-8 inches wide by 28 feet long
- Maximum draft: propeller down controls - 3.5 feet channel bottom and 4.0 feet concrete sill. Some question exists whether a 3.5-foot channel will be maintained naturally by river flows.
- Minimum channel width: Passing pontoons control - 35 feet on straight, 40 feet at bend for safety clearance when passing
- Maximum weight: Small cruisers and pontoons control - 6,450 pounds for a cruiser and 2,700 pounds for a pontoon
- Minimum clear lock chamber size: Consider a mix of boats with a desirable minimum of four in the lock at a time to keep transit time between 15 minutes and 30 minutes with a line-up of four or more boats - width of 20 feet and length of 54 feet

## 7.0 RIVER CHANNEL MODIFICATIONS. -

7.1 - Downstream. - As the normal summer river elevation from the confluence with the Mississippi to the tailwater at the dam is from about 831 to 832, very little work is required in this reach of the river. Some channel deepening would be required under the Main Street Bridge to pro-

vide minimum width of 35 feet and depth of 3.5 feet. The primary work required between about Jefferson Street to Main Street would be removal of boulders and other obstructions. No channel work is anticipated downstream from Jefferson Street. Navigation aids such as channel markers will be required from Jefferson Street to the dam. Because of the limited amount of dredging required, cost of utility relocation was not considered separately, but was included in the contingencies. The existing siphon crossing the Rum River near Adams Street was not evaluated in detail. Preliminary available information shows there may be inadequate depth at the siphon. This would need close consideration during a detailed feasibility study.

7.2 - Upstream. - The normal pool elevation above the dam exceeds 844 during the recreation season. Thus, the primary work required above the dam is some excavation and riprap placement along the eastern shoreline immediately upstream of the spillway to improve channel alignment and approach conditions to the lock or lift. Navigation aids, warning signs and perhaps overflow barriers may also be needed.

7.3 - Bridge Clearance. - Clearance under bridges is a major concern when investigating river navigation. Table I at the end of this report lists the characteristics of the bridges in the length of river being considered for improved boat navigation. The only restrictions may be at the Main Street bridge where the lower end of the eastern arch may cause some headroom interference, at the Highway 10 bridge where headroom clearance may be limited to about 7.0 feet and Pleasant Street bridge which has a minimum headroom clearance of about 9.4 feet.

## 8.0 ALTERNATIVES AT DAM. -

This report section considers a number of alternatives for boat transfer facilities at the Rum River dam. The advantages, disadvantages and relative costs of each alternative are discussed. For ease of comparison, costs for each alternative are summarized in table III at the end of this report.

8.1 Do Nothing. - This alternative is the status quo. It includes the existing minimally developed canoe portage at the dam plus a boat launching facility on the west river bank at the County park approximately 6,000 feet upstream from the dam, and a second boat launch on the east river bank at the City park approximately 2,000 feet downstream from the dam. The advantages of this alternative are it requires no further action by the City council, it does not require additional expenditures of funds and it maintains the current status of the river setting. Its disadvantages are it limits the size and types of boats that can pass the dam, it prevents use of the river by a larger segment of the boating public, and it limits access to the Mississippi River and the Coon Rapids pool from the upper Rum River.

8.2 Motorized Portage. - This alternative would consist of developing a paved pathway approximately 300 feet long around the east end of the dam, docking and launching facilities both upstream and downstream from the dam, a wheeled boat carrier and a motorized tractor. As discussed in Paragraph 6.5, an operator would be required during the boating season. Space for this facility east of the dam is very limited. Reduction in the size of the existing parking lot would probably be

necessary. Costs for initial development plus annual operation and maintenance are shown in table III at the end of this report. At \$150,000 this is the lowest cost alternative of those developments considered. Other advantages include opening the river to a broader segment of the boating public, and it eases access to the Mississippi River and the Coon Rapids pool. Disadvantages include added disruption to the river-setting upstream from the dam from increased boater use, limited sizes of boats that could be handled by a motorized portage, and the relative delay in handling a line-up of boats. Larger pontoon boats, runabouts, and small cruisers are probably beyond the capabilities of a motorized portage.

8.3. Crane or Mechanical Lift. - This alternative would consist of docking facilities upstream and downstream from the dam, ramps to the docks, a mechanical lift system, and a boat cradle or sling. The mechanical lift system could consist of a gantry crane, a stiff leg derrick or other mechanical lifting device. As discussed earlier, an operator would be required during the boating season. As the most feasible location for this facility may be the spillway stilling basin, the spillway may not be available during the boating season. To increase the dam's discharge capacity during the boating season with the spillway out of use it may be necessary to consider replacement of the fixed flashboards with permanent movable crest gates on the dam. The primary advantages of this plan are its moderate cost of \$400,000, ability to handle a wide range of recreational boats, it opens the river to a broader segment of the boating public, and eases access to the Mississippi River and the Coon Rapids pool. Disadvantages include added disruption to the river setting upstream from the dam from increased boater use, possible introduction of undesirable species into the river above the dam, and the relative delay in handling a line-up of boats. Costs are shown in table III at the end of this report.

8.4 Marine Railway. - This alternative would consist of a double-railed cartway about 270 feet long, a circular turn table, docking and launching facilities upstream and downstream from the dam, a wheeled boat carriage, a cableway and a motorized winch. Because of limited space east of the dam, encroachment to the existing parking lot may be necessary. The advantages and disadvantages would be similar to a crane or mechanical lift system, but costs would be somewhat higher at \$450,000 and the risk to boat damage would be less than a crane or mechanical lift system. This system would also require an operator during the boating season. Costs are shown in table III at the end of this report.

8.5 Navigation Lock. - A navigation lock would consist of a concrete or steel sheet pile lock chamber, upstream and downstream gates, filling and emptying systems, upstream and downstream approach guide walls, access ramps, and operations center. Details of a lock and its cost are contained in the following two sections of this report. The advantages and disadvantages are similar to those of the marine railway system except that the lock is the safest and most reliable of the alternatives considered and it has the fastest transit time for a line-up of boats. An additional advantage over the other high capacity systems considered is that only the motorized portage would blend into the existing dam esthetics better than the lock. As discussed in Paragraph 6.5, the lock would also require an operator during the boating season. Permanent and movable crest gates replacing the fixed flashboards would be of benefit for any lock system that would use the existing spillway.

8.6 Discussion of Issues. - The primary issues between the alternatives are relative costs, risk and safety, transit time, and size of boats handled. All alternatives would increase boater use of the river upstream from the dam and ease access to the Mississippi River and Coon Rapids pool. All alternatives would have the disadvantages of changing the river character, added disruption to the setting of the existing river, and possible introduction of undesirable species upstream from the dam. A major issue to be resolved with any boating transfer system would be its impact on a designated wild and scenic river and the appropriateness of a lock or other facility. Is it in keeping with the intent of the designation? The relative disadvantages would increase amongst the alternatives as an alternative would increase boater use because of larger capacity and faster transit time. Tables III and IV located at the end of the report ahead of the sketches compare costs and other issues between the alternatives considered.

## 9.0 NAVIGATION LOCK. -

9.1 Location. - A number of possibilities exist for a lock site at the Rum River dam. The lock could be located east or west of the gated spillway and stilling basin, next to the west abutment, or within the existing spillway stilling basin. Because of limited space, a lock located east of the spillway stilling basin does not appear feasible for this evaluation. Because of access and interference problems, a lock location immediately west of the spillway stilling basin appears less desirable than one next to the west abutment. A lock next to the west abutment would require more downstream channel modifications for boat access than would a lock located near the eastern shore line of the river; however, the western abutment location would minimize interference at the spillway. A new lock need only be sized for a 20-foot wide by 54-foot clear length lock chamber. Even with this small size a completely new lock would cost substantially more than converting the larger size spillway. A detailed feasibility study should evaluate in detail the most desirable lock site and its cost. This study is limited to evaluation of converting the existing spillway stilling basin into a small boat lock. Although this location maximizes spillway interference, it is considered the least costly of the lock alternatives and has good access from and proximity to the city hall. Because of some minimum interference with spillway operation, this alternative would benefit should the fixed flashboards be replaced with permanent movable crest gates on the dam. Use of the existing spillway and stilling basin would create a usable lock chamber 20 feet wide by 68 feet long, which is substantially longer than the 54-foot minimum length. The following paragraphs describe the requirements for converting the spillway stilling basin into a small boat lock.

9.2 Converting Stilling Basin to a Lock. - The sketches at the end of this report and ahead of the appendices show one concept for converting the spillway and stilling basin to a small boat lock. The conversion would permit the use of the spillway to discharge water when necessary, but this activity would stop lock operations.

The existing spillway Tainter gate and hoisting equipment would be removed as would the bridge at the downstream end of the stilling basin. Concrete surfaces and other items would be removed as needed to accommodate new construction.

The major concern of conversion is to assure the continuous structural soundness and stability of the existing stilling basin walls when raised and converted to lock chamber walls. Thus, much of the cost and construction would be to raise and strengthen these walls. Confirmation of the structural soundness and stability of the converted stilling basin would be a major activity of a detailed engineering feasibility analysis.

Because it is unlikely that the existing structure could be modified to hold new downstream lock gates, the concept includes a new downstream concrete monolith for these facilities. This monolith would contain the emptying culvert and gate. Also to control seepage at the increased hydraulic pressures, a sheetpiling cut-off wall would be installed surrounding the converted stilling basin.

The new spillway gate and hoist at the upstream end would be an overflow type Tainter gate and would serve as a lock gate, lock filling gate and spillway gate. Baffles would be constructed immediately downstream from this gate to distribute inflow and dissipate excess turbulence.

Construction would include a new lock crossing bridge, access ramps meeting ADA requirements, railing, power, control systems, lighting, operating station, mechanical systems, clean-up and landscaping.

To assist boats approaching the lock, guidewalls would be constructed both upstream and downstream from the lock. Limited channel dredging in the river upstream and downstream from the lock would assure minimum navigation depths and remove obstructions. Because the channel modifications downstream from the dam would be minimal, little change in downstream river flows or levels would occur. Thus, no adverse impacts to the flow and operating characteristics at the dam apron would be expected. A detailed analysis during engineering feasibility studies should be made for confirmation. Signs, channel markers and other navigation aids would be included.

A major expense during construction would be temporary cofferdams and dewatering required to permit construction at a wet site. Costs for all work needed to convert the spillway to a lock are summarized in the following section.

9.3 Impacts of Lock on Existing Dam. - Any small boat lock or mechanical lift that would reduce the width of the overflow section or hamper operation of the spillway gate would reduce the discharge capacity of the dam. If the spillway were converted to a lock, the gate in the spillway would have reduced capacity because of a longer approach path and possibly reduced width.

A new lock through the overflow section could increase dam discharge capacity if the lock would include a gate capable of acting as a spillway gate. In either case converting the fixed flashboard to permanent movable crest gates would offset capacity loss during the spring and summer operating season when flashboards are normally in place.

Any lock construction at the dam may interfere with the foundation drainage system, increase uplift and reduce structural stability. This would require detailed analysis during an engineering feasi-

bility study as would the impact of raising the stilling basin walls on stability.

## **10.0 ESTIMATE OF COSTS. -**

10.1 Basis of Estimate. - This estimate is developed using a concept design and is of a preliminary scope. Thus, a 30 percent contingency was added to the estimated construction costs. Feasibility studies, engineering and design, supervision and inspection and administration are added at about 17 percent of the construction estimate. Unit costs were developed from prices of recent, similar construction projects in the region. The estimate is considered to be appropriate until June 1994 and, if used after that time, should be adjusted for inflation and cost growth. The estimate is suitable for a budget estimate and as information needed to make a decision to continue to a detailed feasibility study. It should not be used as an estimate of actual construction costs or for bid evaluation. These costs would be developed as part of a detailed feasibility study.

10.2 Total Estimate of Cost. - The total budget level estimate of cost for converting the spillway stilling basin to a small boat lock is \$3,000,000. Table IV at the end of the report ahead of the sketches summarizes the costs by feature.

## **11.0 OTHER CONSIDERATIONS. -**

11.1 Permanent Movable Crest Gates on Overflow. - If the existing fixed flashboards would be converted to permanent movable hinged crest gates, dam operation for the mechanical lift and spillway conversion alternatives would be significantly improved during the summer season. This type of gate would also eliminate the significant and labor intensive effort to install each spring, and remove each fall, the flashboards on the overflow section. Installation of permanent hinged crest gates would cost about \$1,100,000 (budget estimate) and significantly reduce the existing annual operation and maintenance costs. An alternative to a hinged crest gate could be considered in a detailed feasibility study. An inflatable rubber crest dam could be considered, but its reliability and durability may be questionable. However, cost would be significantly less than a hinged leaf gate. Flashboard replacement costs approximately every three years would also be eliminated. A detailed total life cycle cost comparison between the two systems is beyond the scope of this evaluation. As this issue can be considered separately and independently from a lock development, it could be the subject of an independent feasibility study, and may have significant merit as a long term cost and labor saving measure.

11.2 Pedestrian Bridge at Dam. - A pedestrian bridge could be constructed at the dam for about \$680,000 (budget estimate). Since a bridge is totally independent from a lock project, it could be the subject of an independent feasibility study. A detailed feasibility study is beyond the scope of this evaluation. This evaluation considered placing the bridge as an independent structure downstream from the dam for two main reasons. First, adverse impact on the structural stability of the dam should the bridge be constructed on the dam is a major concern. Second, a bridge downstream from the dam would provide an excellent view of the dam, particularly at night, that would not be available if the bridge were on top of the dam.

11.3 Environmental Concerns. - These concerns could be addressed in an Environmental Assessment Worksheet (EAW) completed as part of a detailed feasibility study. The EAW could address not only the concerns for introduction of undesirable species, beneficial and adverse environmental impacts, added boating traffic, changed character and setting of the river, policing and safety concerns, beneficial and adverse economic impacts and community impacts, but also community acceptance using an effective public participation program. Coordination, review and approval of a lock facility would be required with the Minnesota Department of Natural Resources to resolve impacts and appropriateness with the Wild and Scenic River designation.

11.4 Regulatory Permits. - The following is a list of permits and reviews with responsible agencies that would be required during a detailed feasibility study. It is important to understand that permit review and process time, the public interest review, and agency review and acceptance may drive the development process, particularly its timing.

<u>Activity</u>	<u>Agency</u>
Plan Review and Approval	City of Anoka Anoka County Lower Rum River Watershed District Water Management Organization Minnesota DNR - Waters, Dam Safety
Permit - Section 404 and Section 10	U.S. Army Corps of Engineers, with review by USF and WL Service and EPA
Permit - Work in Public Waters and Dewatering pumping	Minnesota DNR - Waters
Compliance with Wild and Scenic Rivers designation	Minnesota DNR - Waters
Water Quality Certification - Section 401	Minnesota PCA

11.5 Operation and Maintenance. - Labor requirements and costs for routine operation and preventative maintenance need to be added to the initial capital investment for development. These costs together with costs of investment for future major repairs, rehabilitation and replacement have been evaluated and are shown in Table III, COST OF ALTERNATIVES CONSIDERED. As

discussed in Paragraph 6.5, any system or alternative containing operating machinery and equipment of the complexity anticipated would require a trained operator, probably a city employee, whenever the system is open for business. This should be considered when looking at staffing for operation and preventative maintenance. Annual operation and maintenance costs would vary from \$25,000 to over \$33,000 of which from \$17,000 to about \$21,000 would be for the salary of the operating staff. The remainder would be for seasonal startup and close-down and for periodic preventive maintenance and repair.

11.6 Risk and Liability. - Any activity near a flowing river or dam involves some hazard and risk. Add moving machinery and more than a few people and the risk will increase. Location of a recreational facility such as a lock at the site will increase the number of people, and will add to the previously stated risk. The added risks would consist primarily of injury and accidents to boaters, including the possibility of drowning plus damage to boats due to operator error or equipment failure. Since the city would be the owner of the lock facility, its liability for accidents at the site will increase. Any increase to premiums for liability insurance should be considered and assessed as a cost of project development. Assessing these costs is beyond the scope of this preliminary evaluation but should be included in any detailed study of financial and economic feasibility.

11.7 Future Actions. - Should the Anoka City Council determine that further action and study toward development of a small boat lock at the Rum River dam would be undertaken, the following is a list of activities, in order, that are necessary:

- 11.7.1 - Market analysis of desirability, acceptability, need, demand, use and willingness to pay
- 11.7.2 - Selection of consultants
- 11.7.3 - Financing study and allocation of costs. Cost of a detailed study may exceed \$25,000.
- 11.7.4 - Feasibility study of engineering and technical issues including an EAW and benefit/cost analysis. Cost of this study may exceed \$120,000.
- 11.7.5 - Permit process, reviews and approvals
- 11.7.6 - Develop construction documents, plans and specifications
- 11.7.7 - Advertise, bid, and award contracts
- 11.7.8 - Construction of project
- 11.7.9 - Develop operation and maintenance manuals
- 11.7.10- Operator and maintenance training
- 11.7.11- Turn over to city
- 11.7.12- Assess costs and close out project

11.8 Impact of Changed Operations at Coon Rapids Dam. - A draft management plan for the Coon Rapids dam on the Mississippi River about 5 miles downstream from the City of Anoka will consider a number of options for the dam. The plan is being developed by the Suburban Hennepin Regional Park District and may consider options from complete removal of the dam to development of a hydroelectric power facility at the site. The Suburban Hennepin Regional Park District has indicated the management plan is scheduled for completion in late September 1993. A decision on the

Dam would follow this date. Any plan that would alter levels and flows on the Mississippi River has the potential to impact the City of Anoka and the Rum River dam.

Removal of the Coon Rapids dam from the Mississippi River would result in the river reverting from a slack water pool to a free flowing open river. This would result in a moderate increase in average river velocity, a significant increase in the fluctuation of water levels, a slightly narrower river, a somewhat shallower river, an increase in exposed river banks and shoreline and increased erosion to river banks and shoreline. The most pronounced effects would be the shallower river and greater fluctuation in water levels.

Information furnished by the U. S. Geological Survey and analyzed in this study indicates that normal fluctuations in May through October river levels at the mouth of the Rum River would increase from about 1.3 feet normal fluctuation with the dam to about 4.4 feet without the dam or about a 3-foot increase in fluctuation. Normal water depths would decrease about 1.5 feet at higher flows and about a 4.5-foot decrease at the lower flows for the same May through October period.

The Mississippi River pool backs up the Rum River to about Madison Street extended and has only a very slight backwater effect at the Rum River dam at normal summer levels and flows.

At flows larger than about 30,000 cfs. (about the 2 year flood), the Coon Rapids dam has no influence on water levels at the mouth of the Rum River and levels would be the same with or without the dam.

11.9 Pulsations at Dam Overflow. - Observation of the dam over a range of flow conditions indicates a mild vibration or pulsation at several conditions. When overflow is about 0.1 foot or lower in depth over the crest, it appears that the pulsation ceases. Overflow in the range of about 0.1 foot depth to about 0.5 foot appears to cause a noticeable pulsation. When depth is over 0.5-foot to about 1.0-foot, either the pulsation is masked by other sensations, or the pulsation stops. Pulsation was observed with about 1.5 feet of water over the dam crest without flashboards in place. It has been reported that pulsations also occur when about 3 feet of water flows over the dam without the flashboards in place; however, this condition was not observed during this study.

The cause for the pulsation at the 1.5 and 3.0 feet of overflow may be the result of inadequate air supply from either inadequately spaced or sized air vents or from water impacting on the downstream basin floor with inadequate pool depth in the impact area. Further investigation of these conditions may be warranted, but are beyond the scope of this preliminary assessment.

Because the dam has vents to supply air to the underside of the overflow, lack of air is probably not a primary cause of the pulsation at the very low overflow depths. When the pulsation occurs at very low flows and because the vents are at the overflow ends being 236 apart, a likely cause of the pulsation may be inertia in the large air mass that must move to supply air at very low air demand. This could cause reduced pressure and small pulses at points along the length of the overflow before the mass of air could move to overcome the reduced pressure. The condition may be reme-

died by introducing air at a number of locations along the width of the overflow.

A normal fix for this condition would be the installation of flow splitters to cause an air gap in the overflow at a number of locations along the overflow. Flow splitters are a standard feature for most hinged crest gates with vertical drop and a cavity behind the overflow. Further investigation of the use of flow splitters may be warranted, but is beyond the scope of this preliminary assessment.

## **12.0 CONCLUSIONS. -**

12.1 The Rum River and its drainage area supply adequate run-off, flows and levels to permit development of a small recreational craft navigation system on the river from its confluence at the Mississippi River for a distance of about 6 to 8 miles upstream.

12.2 The Rum River dam increases river levels for a distance of about 7 miles above the dam.

12.3 The site of the Rum River dam is constricted but adequate for a small boat lock or other boat transfer facility.

12.4 No known structural conditions at the dam or its foundation would prevent construction of a small boat lock at the dam.

12.5 A navigation system could be developed on the river and at the dam to accommodate small boats from canoe size up to and including pontoon boats, runabouts and small cruisers requiring a maximum water depth clearance (draft) of 3.5 feet.

12.6 Minimum lock dimensions would be 20 feet wide by 54 feet long with 4.0 feet clear draft. Transit time would average 30 minutes and vary between 15 and 45 minutes.

12.7 The existing spillway and stilling basin at the dam could be converted to a small boat lock for a cost of about \$3,000,000.

12.8 Possible alternatives to a lock include a motorized portage costing \$150,000 and a mechanical lift system costing \$450,000.

12.9 Only moderate excavation and dredging to the river channel downstream and upstream from the dam would be required to develop recommended navigation water depth (draft) of 3.5 feet. The 3.5 feet of draft may not be maintained naturally by the river downstream from the dam. Thus, the river may need some periodic dredging to maintain a 3.5-foot depth.

12.10 A lock or other boat transfer facility may alter the existing character of the river and add to the possibility of the introduction of undesirable species.

12.11 Permanent automatic crest gates costing \$1,100,000 may have merit as an independent undertaking or in support of a lock development.

12.12 A new pedestrian bridge located immediately downstream from the dam and costing about \$680,000 may have merit as an independent undertaking or as a supplement to lock development.

12.13 Costs of operation, preventive maintenance and future repair and replacement may be substantial and need to be considered.

12.14 Construction of a lock at the dam would pose some added hazard, risk and liability to the City of Anoka.

12.15 Should the City of Anoka determine that it is in its interest to continue toward lock development, the process should be phased a step at a time starting with a market analysis, next a detailed financial analysis, followed by a detailed feasibility study.

12.16 Modifications to operation of the Coon Rapids dam may have adverse impacts on the Mississippi and Rum Rivers in the City of Anoka and on the feasibility of developing a small boat navigation system at the Rum River dam.

12.17 Further investigation of the installation of flow splitters to eliminate the pulsations at the dam may have merit.

12.18 Agency review and permit processing including an EAW and resolution of appropriateness concerning the Wild and Scenic River designation could add significant issues and time to any project completion schedule.

### **13. RECOMMENDATIONS. -**

13.1 Should the City of Anoka determine that it is in its interest to consider further development of a lock costing up to about \$3,000,000, or a mechanical lift or marine railway costing about \$450,000, it is recommended that a market analysis of desirability, acceptability, demand, need, use and willingness to pay be undertaken prior to investing substantial funds in a detailed feasibility study.

13.2 Secondly, prior to undertaking a detailed feasibility study, the impact of the Minnesota Wild and Scenic Rivers Act and the designation of the Rum River as a Wild and Scenic River needs examination. The question would be: Is added boating traffic as encouraged by a lock in keeping with the intent of the Wild and Scenic Rivers designation?

# TABLES

## LIST OF TABLES

<u>TABLE NUMBER</u>	<u>DESCRIPTION</u>
I	Bridge Data
II	Summary of Small Boat Dimensions
III	Cost of Alternatives Considered
IV	Relative Advantages, Disadvantages, Issues
V	Summary Cost Estimate: Convert Spillway to Lock

## TABLE I

### BRIDGE DATA

<u>Location from dam</u>	<u>River Mile from conf. with Miss.</u>	<u>Name/Type</u>	<u>Owner</u>	<u>Clear Width</u>	<u>Vertical Clearance @ Elev. 832 D.S. &amp; Elev. 844.5 U.S. at normal summer flow</u>	<u>Remarks</u>
600' DS	0.7	Foot Bridge	Anoka City	Unrestricted west span	Much greater than 12'	No apparent restrictions to small boat traffic through west span
400' DS	0.75+	Main Street	Anoka City	50' at Center of East Arch	Arch 9.5' @ shoreline 12.0' @ 6' out from shore	Navigation should be restricted to central 50' of east arch span
2,400' US	1.2+	US Highway #10	MNDOT	Unrestricted >40'	7'	Least headroom of all upstream bridges
3,000' US	1.4-	Pleasant Street	Anoka County	Unrestricted >40'	9.4'	Could cause restrictions to pontoons with canopy on top
4,000' US	1.5+	Railroad Bridge	BN	Unrestricted >40'	16.5'	No apparent restrictions
4,020' US	1.5+	Railroad Bridge	BN	Unrestricted >40'	16.5'	No apparent restrictions
2.5 MI US	3.3	County Road 116	Anoka County	Unrestricted >40'	11.1'	No apparent restrictions
9.3 MI US	10.1	County Road 7	Anoka County	Unrestricted >40'	Unknown	Probably above navigable reach for all but least draft small boats.

## TABLE II

### SUMMARY OF SMALL BOAT DIMENSIONS

<u>Type</u>	<u>Length Range (Ft. &amp; In.)</u>	<u>Beam Range (Ft. &amp; In.)</u>	<u>Draft w/o Propeller (inches)</u>	<u>Draft with Propeller Down (inches)</u>	<u>Overall Hull Depth (inches)</u>	<u>Engine Range (Horsepower)</u>	<u>Minimum Bridge Clearance (Ft. &amp; In.)</u>
<b>Canoe</b>							
From	15' - 0"	30"	6"	20"	18"	0	3' - 0"
To	17' - 0"	39"	9"	28"	24"	5	3' - 6"
<b>Jon Boat</b>							
From	10' - 0"	46"	6"	20"	15"	3	3' - 0"
To	16' - 0"	75"	9"	28"	23"	40	4' - 0"
<b>Skiff</b>							
From	11' - 7"	58"	6"	27"	20"	10	3' - 0"
To	16' - 2"	67"	12"	30"	29"	40	4' - 0"
<b>Fish/Bass Boat</b>							
From	15' - 0"	63"	12"	28"	19"	25	4' - 0"
To	20' - 7"	92"	15"	32"	42"	120	5' - 0"
<b>Runabout</b>							
From	16' - 7"	70"	11"	27"	28"	60	3' - 0"
To	22' - 0"	97"	18"	33"	48"	300	5' - 0"
<b>Pontoon</b>							
From	17' - 0"	96"	10"	27"	24"	10	5' - 0"
To	28' - 0"	104"	15"	32"	60"	250	11' - 0"
<b>Small Cruiser</b>							
From	19' - 6"	94"	17"	27"	34"	75	3' - 0"
To	26' - 9"	114"	23"	40"	42"	300	6' - 9"

NOTE: All information from manufacturer's literature

## TABLE III

### COST OF ALTERNATIVES CONSIDERED

<u>Alternative</u>	<u>Total Budget Estimate of development</u>			<u>Average Annual Operation and Preventative Maintenance Cost (\$)</u>	<u>Average Annual Cost of Long-term Repair and Replacement (\$)</u>	<u>Total Average Annual Cost (\$)</u>
	<u>Total Budget Cost (\$)</u>	<u>Economic Life (years)</u>	<u>Average Annual Cost (\$)</u>			
Do nothing	- 0 -	Unknown	- 0 -	Unknown, but minor	Unknown, but minor	Unknown, but minor
Motorized Portage	\$150,000	20	15,280	25,000	2,840	43,120
Crane/Mechanical Lift	\$400,000	35	34,320	31,000	2,060	67,380
Marine Railway	\$450,000	40	37,740	33,200	1,550	72,490
Navigation Lock	\$3,000,000	60	242,400	25,300	1,600	269,300

#### NOTES ON TABLE III

1. All figures are approximations to be refined during feasibility analysis.
2. Economic life is age when major rehabilitation and replacement of mechanical systems is necessary.
3. Costs are annualized at 8% annual compound interest. Capital investment is paid by series bond over the life of the project.
4. Total average annual cost is the sum of the preceding three columns.
5. Future costs are assumed to be at it's current value with zero inflation.

**TABLE IV**

**RELATIVE ADVANTAGES, DISADVANTAGES, ISSUES**

<b><u>Alternative</u></b>	<b><u>Average Annual Cost (\$)</u></b>	<b><u>Transit Time Line of 4 boats Last Boat (Minutes)</u></b>	<b><u>Boat Size</u></b>	<b><u>Safety as Risk</u></b>	<b><u>Disrupt River setting By Added Boating</u></b>	<b><u>Introduce Undesirable Species</u></b>	<b><u>Ease of Use</u></b>
Do Nothing	Minimal	Unknown	Limited	Low	Least	Least Likely	Most difficult
Motorized Portage	43,120	23 to 158 Last = 158	Limited	Low	Least	Least Likely	Most difficult
Crane/Mechanical Lift	67,380	23 to 140 Last = 140	Good range	Highest	Higher	Highly Likely	Easier
Marine Railway	72,490	23 to 147 Last = 147	Good Range	Moderate	Higher	Least Likely	Easy
Navigation Lock	269,300	15 to 45 Ave. = 30	Widest Range	Lowest	Most	Most Likely	Easiest

## TABLE V

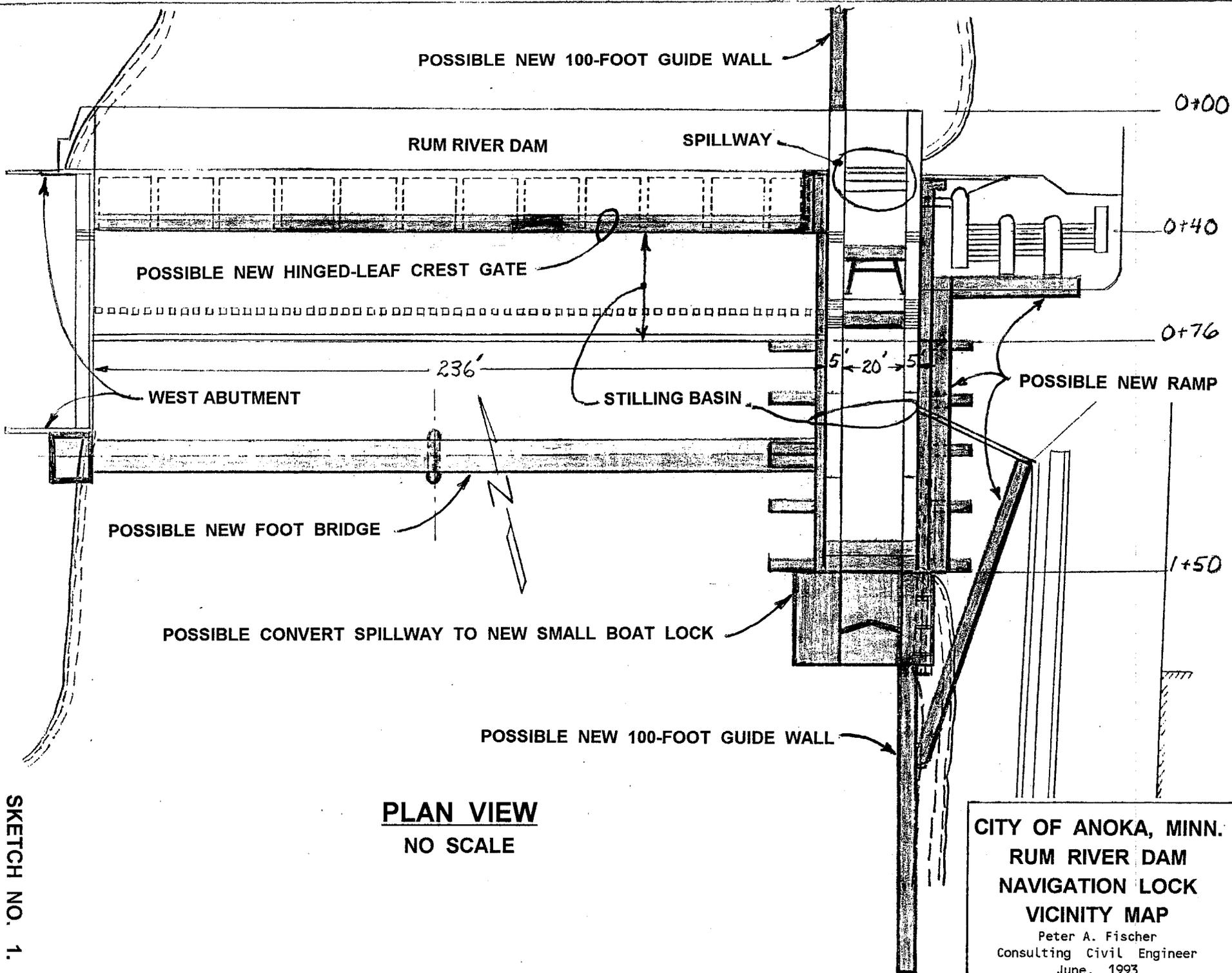
### SUMMARY COST ESTIMATE CONVERT SPILLWAY TO LOCK

<u>ITEM</u>	<u>ESTIMATE OF COST</u>
MOBILIZATION & DEMOBILIZATION	\$ 10,000
REMOVALS - Concrete, riprap, cribbing railings, lights, equipment, misc.	62,000
LOCK -	
Upstream inlet	98,000
Downstream monolith	285,000
Convert spillway walls to lock chamber	557,000
Sheetpile cut-off wall	140,000
Piling-load carrying	72,000
Equipment, gates, hoists, etc.	160,000
Power, control lighting	107,000
RAMPS & BRIDGE	82,000
UPSTREAM GUIDEWALL	32,000
DOWNSTREAM GUIDEWALL	32,000
RAILINGS & SIGNS AT LOCK, RAMPS, GUIDEWALLS	121,000
UPSTREAM & DOWNSTREAM CHANNEL WORK	31,000
NAVIGATION AIDS & SIGNS	9,000
COFFERDAMS & DEWATERING	<u>172,000</u>
SUBTOTAL - DIRECT CONSTRUCTION	\$1,970,000
SUBTOTAL CONSTRUCTION CONTINGENCY AT 30%	<u>590,000</u>
TOTAL CONSTRUCTION	\$2,560,000
FEASIBILITY STUDY, ENGINEERING & DESIGN, SUPERVISION & INSPECTION, 15%	390,000
ADMINISTRATION, 2%	<u>50,000</u>
TOTAL BUDGET ESTIMATE	\$3,000,000

# SKETCHES

## LIST OF SKETCHES

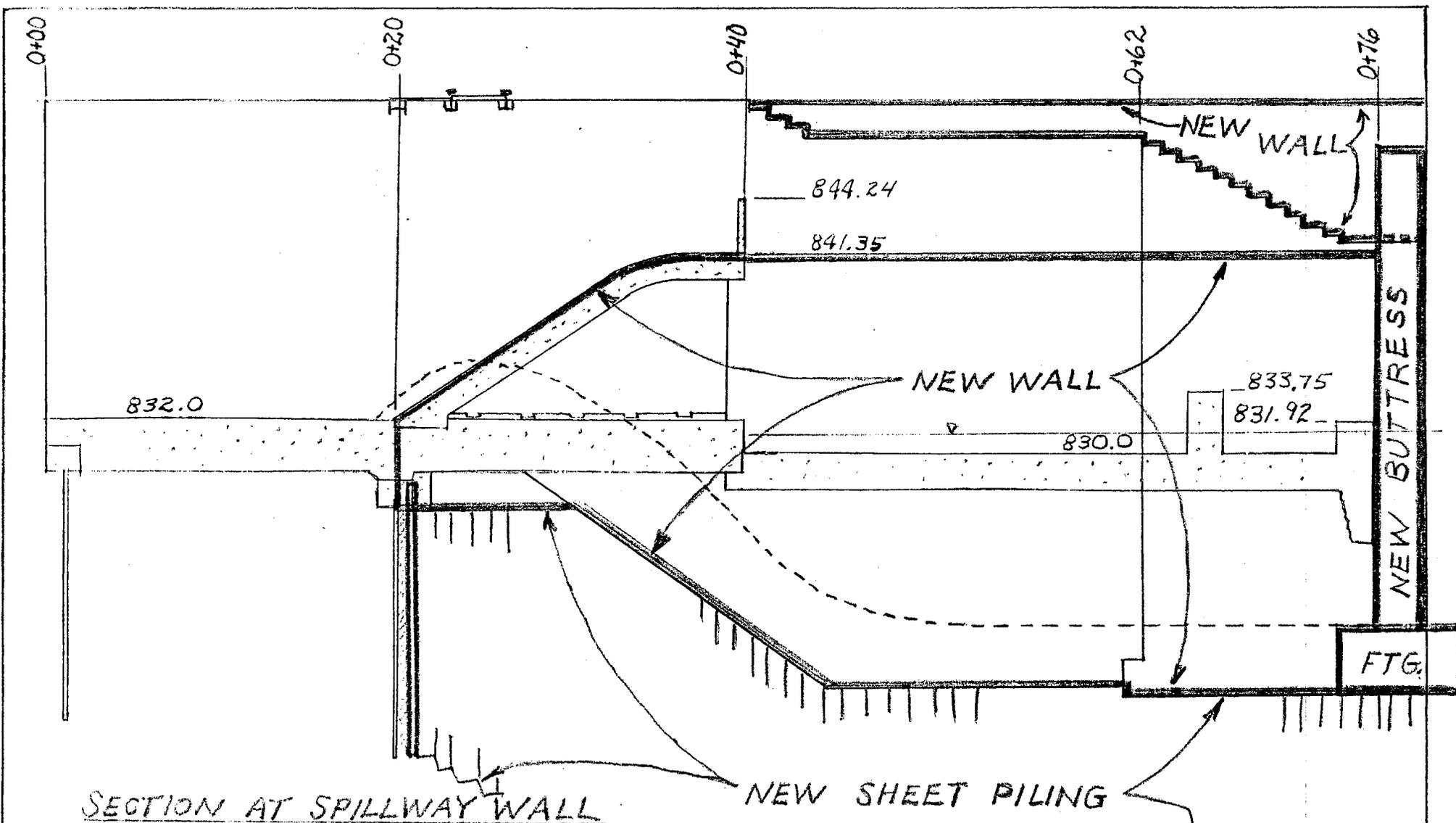
<u>SKETCH NUMBER</u>	<u>DESCRIPTION</u>
1	Vicinity Map
2	Dam Overflow Section
3	Upstream Monolith
4	Lock Chamber
5	Lock Chamber
6	Downstream Monolith
7	Downstream Monolith



**PLAN VIEW**  
NO SCALE

SKETCH NO. 1.

**CITY OF ANOKA, MINN.**  
**RUM RIVER DAM**  
**NAVIGATION LOCK**  
**VICINITY MAP**  
 Peter A. Fischer  
 Consulting Civil Engineer  
 June, 1993



SKETCH NO. 2.

**PLAN SECTION**  
**NO SCALE**

**CITY OF ANOKA, MINN.**  
**RUM RIVER DAM**  
**NAVIGATION LOCK**  
**DAM OVERFLOW SECTION**  
 Peter A. Fischer  
 Consulting Civil Engineer  
 June, 1993

0+00

0+40

0+62

REMOVE

NEW WALL

NEW GATE & HOIST

NEW

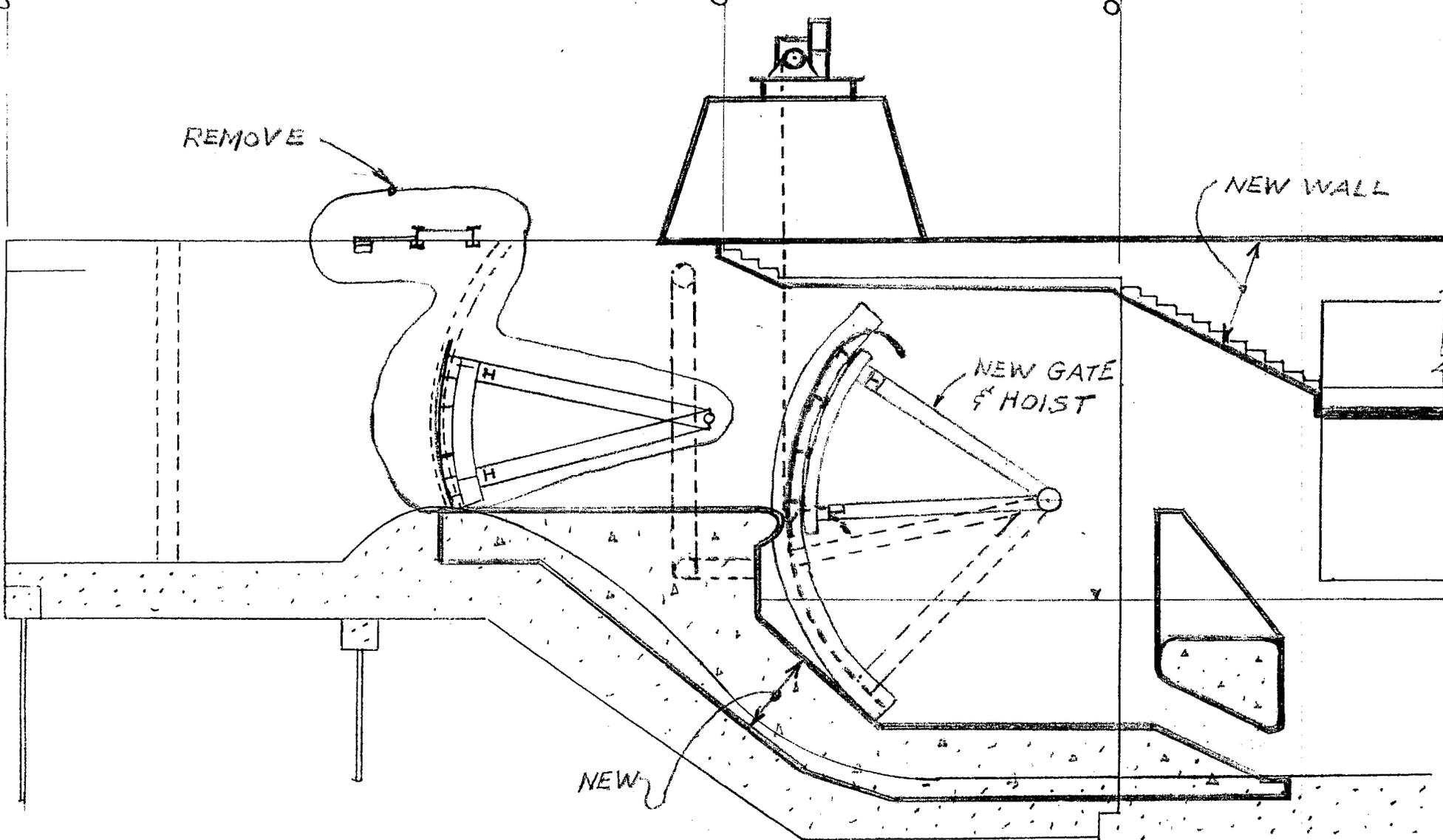
**PROFILE VIEW**

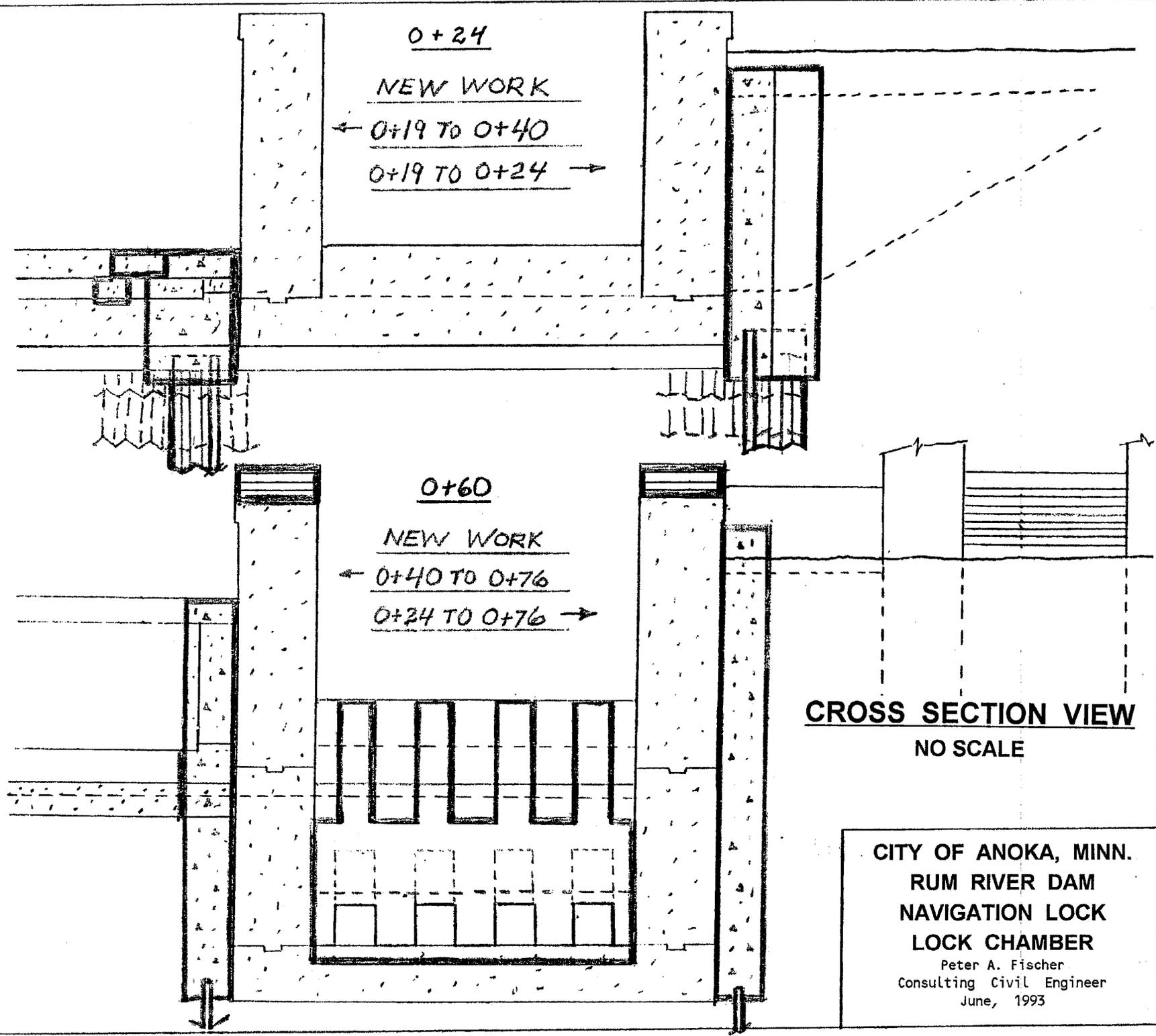
NO SCALE

**CITY OF ANOKA, MINN.  
RUM RIVER DAM  
NAVIGATION LOCK  
UPSTREAM MONOLITH**

Peter A. Fischer  
Consulting Civil Engineer  
June, 1993

SKETCH NO. 3.

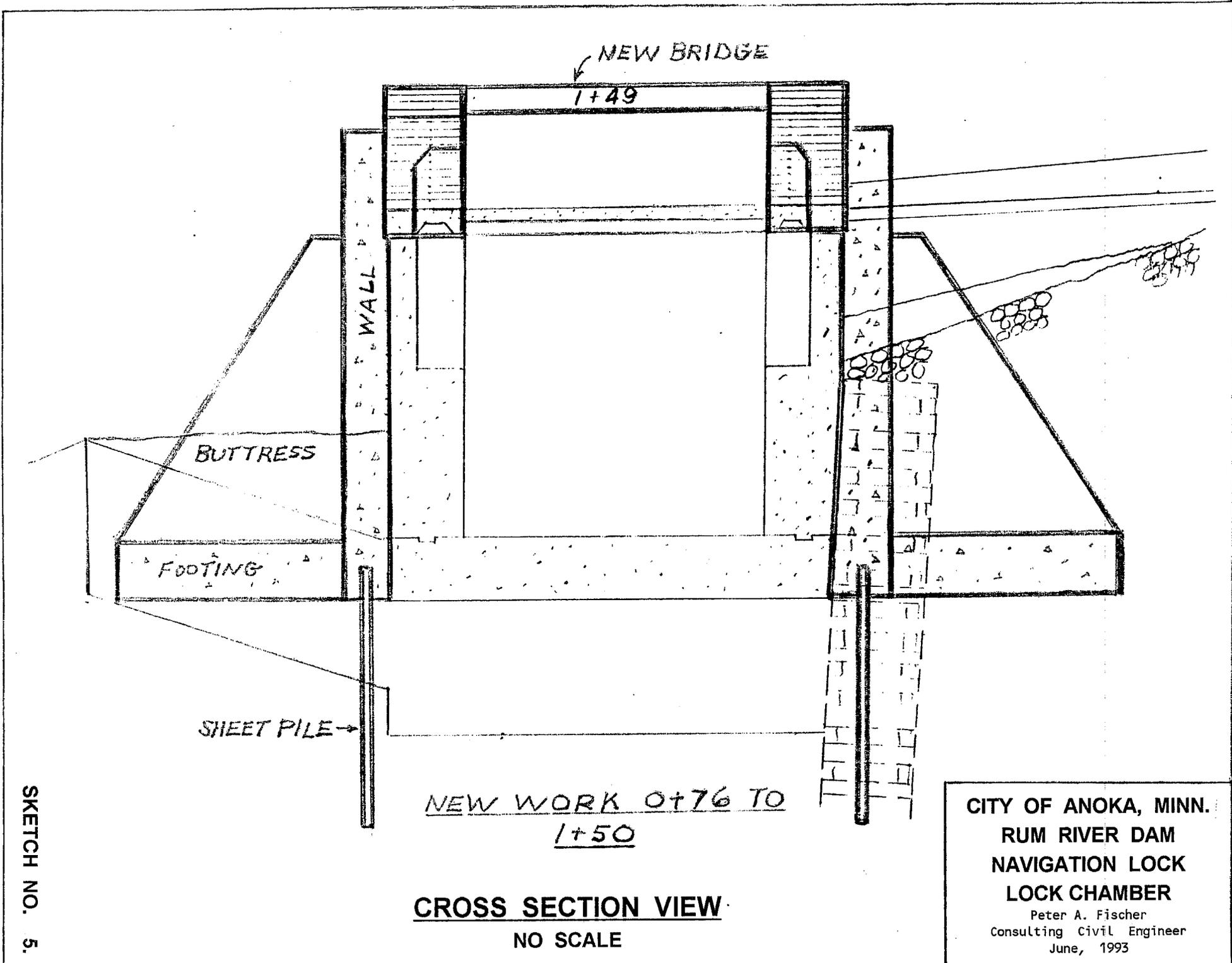




**CROSS SECTION VIEW**  
NO SCALE

**CITY OF ANOKA, MINN.**  
**RUM RIVER DAM**  
**NAVIGATION LOCK**  
**LOCK CHAMBER**  
 Peter A. Fischer  
 Consulting Civil Engineer  
 June, 1993

SKETCH NO. 4.

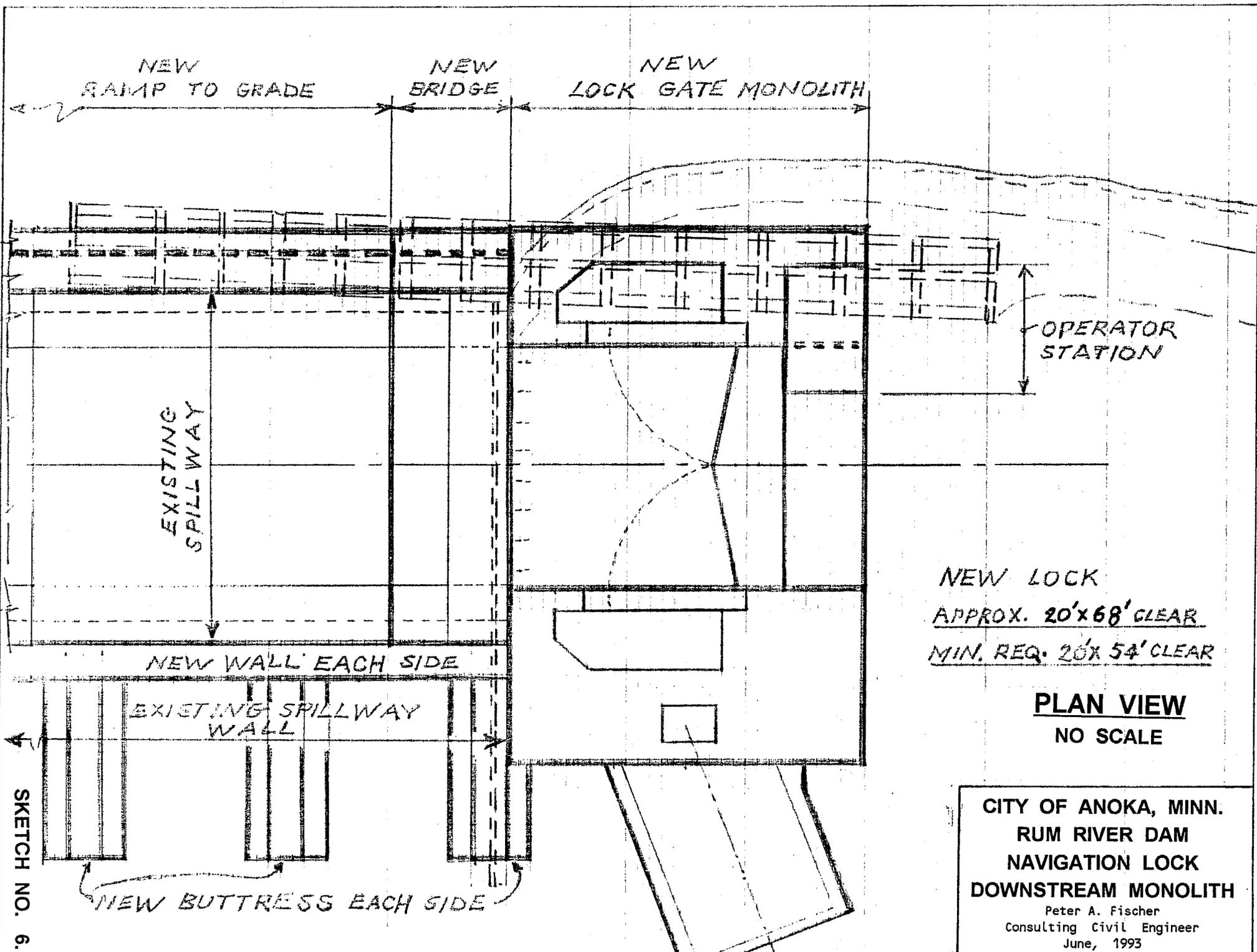


SKETCH NO. 5.

NEW WORK 0+76 TO  
1+50

CROSS SECTION VIEW  
NO SCALE

CITY OF ANOKA, MINN.  
RUM RIVER DAM  
NAVIGATION LOCK  
LOCK CHAMBER  
Peter A. Fischer  
Consulting Civil Engineer  
June, 1993



OPERATOR STATION

NEW LOCK  
APPROX. 20'x68' CLEAR  
MIN. REQ. 20'x54' CLEAR

**PLAN VIEW**  
 NO SCALE

CITY OF ANOKA, MINN.  
 RUM RIVER DAM  
 NAVIGATION LOCK  
 DOWNSTREAM MONOLITH  
 Peter A. Fischer  
 Consulting Civil Engineer  
 June, 1993

SKETCH NO. 6.

NEW BUTTRESS EACH SIDE

EXISTING SPILLWAY WALL

NEW WALL EACH SIDE

EXISTING SPILLWAY

NEW RAMP TO GRADE

NEW BRIDGE

NEW LOCK GATE MONOLITH

+50

EXISTING SPILLWAY WALL

NEW LOCK GATE MONOLITH

NEW BRIDGE

OPERATOR STATION

NEW WALL

EXISTING WALL

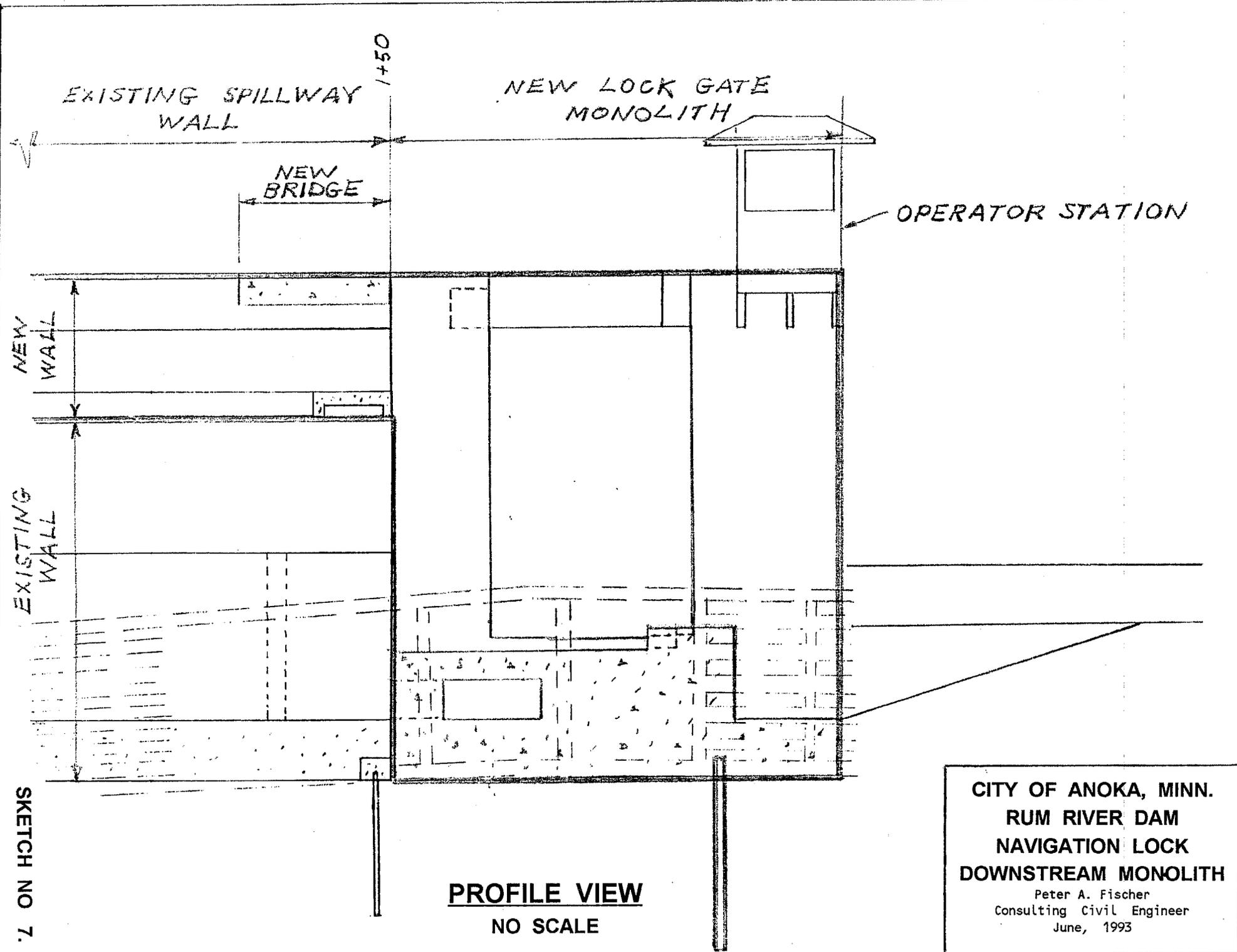
SKETCH NO 7.

PROFILE VIEW

NO SCALE

CITY OF ANOKA, MINN.  
RUM RIVER DAM  
NAVIGATION LOCK  
DOWNSTREAM MONOLITH

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June, 1993



## APPENDIX A

### LIST OF INFORMATION AND REFERENCES REVIEWED AND EVALUATED

1. Report "Preliminary Design, Rum River Channel Improvement, Anoka, Minnesota, Barr Engineering Co., July 1967
2. Drawings "As Built Construction Plans, Rum River Dam, Anoka, Minnesota, Barr Engineering Co., October 1970
3. Drawings Construction Drawings of Main Street Bridge, Short, Elliott, Hendrickson Inc.
4. Map Mississippi River, Canoe Route, St. Cloud to Anoka, MDNR, April 1986
5. Map Mississippi River, Canoe Route, Anoka to Fort Snelling, MDNR, April 1987
6. Map Rum River, Canoe Route, MDNR, March 1990
7. Map Anoka Area Map, Anoka Area Chamber of Commerce, 1986
8. Map Anoka, Minnesota Quadrangle, 7.5 Minute Series, USGS, 1967
9. Profile Mississippi River Low Flow, City of Anoka, Minnesota, 24 September 1966
10. Profile Profiles of Rum River at Anoka, Minnesota, Floodway Profile, USGS and US Corps of Engineers, 1973
11. Cross sections Rum River, Anoka, Minnesota, Sections 17.5- 18.7, 150-165, 166-172, Profile through Anoka, USGS, US Corps of Engineers, 1973
12. Report Open File Report, Coon Rapids Pool Hydrographic Survey, USGS, July 1974
13. Maps (5) Flood Hazard Boundary Maps, Flood Hazard Insurance Rate Maps, City of Anoka, Minnesota, US Dept. of HUD, FIA, February 27, 1976
14. Data Gauge Readings - 1989 Rum River Gauge Readings, Anoka, Minnesota
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16. Map Hydrological Unit Map - 1974, State of Minnesota, USGS, 1976
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18. Paper Flow Characteristics of Minnesota Streams, Technical Paper 4, MDNR, USGS, 1971
19. Reference Walker's Building Estimators' Reference Book, 24th Edition, Frank R. Walker Company, Lisle, Illinois, 1992
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21. Reference Report on Small Craft Harbors, Manuals and Reports on Engineering Practice No. 50, ASCE, 1969
22. Reference Civil Works, Canalization, The Engineer School, Fort Belvoir, Virginia, Corps of Engineers, January 1950
23. Reference Engineering and Design, Navigation Locks, EM 1110-1-1601, USCOE, June 1959
24. Reference Engineering and Design, Hydraulic Design, Navigation Locks, EM 1110-2-1604, USCOE, April 1956
25. Map Survey of the Mississippi River, Chart No. 203, Mississippi River Commission, 1898
26. Maps Hydrologic Investigations Atlas HA-509, Water Resources of the Rum River Watershed East-Central Minnesota, USGS, 1974
27. Data Flow and Duration data, Coon Rapids Gage, USGS, period of record

**APPENDIX B**  
**CONTACTS WITH OFFICIALS AND OTHER INTERESTS**

1. City of Anoka. -  
Contacts: Councilman Weaver  
City Manager  
Public Works Director  
Interested Businessman Weaver  
Purpose: Obtain background information and local views, negotiate scope of work, coordinate, and approval of plans
  
2. Suburban Hennepin Regional Park District. -  
Contacts: Director  
District Engineer from Department of Planning and Engineering  
Purpose: Obtain information on normal operating schedule, obtain river elevation data, obtain information on management plan, coordinate plans
  
3. Anoka Waste Water Treatment Plant. -  
Contact: Maintenance Worker  
Purpose: Obtain data on river levels
  
4. Minnesota Department of Natural Resources. -  
Contacts: Dam Safety Engineer, Division of Waters  
Coordinator of Wild and Scenic Rivers Program, Division of Waters  
Regional Hydrologist, Division of Waters  
Purpose: Obtain information on jurisdiction, permit process, dam safety, coordination, plan review, and approval
  
5. Mississippi National River and Recreation Area of the National Park Service. -  
Contacts: Superintendent  
Chief of Planning  
Purpose: Obtain information, coordinate plans, jurisdiction on Rum River ends at about Madison Street
  
6. U.S. Army Corps of Engineers, St. Paul District. -  
Contacts: Chief, Hydraulics Section, Engineering Division  
Chief, Cost Estimating Section, Engineering Division  
Public Affairs Officer  
Purpose: Obtain river, cost, and navigation traffic data, coordination, plan review, permit process
  
7. U.S. Geological Survey. -  
Contact: Staff Hydrologist  
Purpose: Obtain river level and discharge data, obtain open file reports on river