FISH CREEK COLLECTION SYSTEM

EXECUTIVE SUMMARY

OF THE

INTERIM PHASE I

CONCEPT DESIGN REPORT

Prepared for

WATER DEVELOPMENT COMMISSION

November 1986
FISH CREEK COLLECTION SYSTEM

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OF THE

INTERIM PHASE I
CONCEPT DESIGN REPORT

Prepared for

WYOMING WATER DEVELOPMENT COMMISSION
CHEYENNE, WYOMING

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NOVEMBER 1986
SUMMARY AND RECOMMENDATIONS

Summary

The Interim Phase I Concept Design Report provides a proposed scheme of development for the Fish Creek Collection System, a trans-basin diversion plan to move water from the Little Snake River Basin into the North Platte River basin. This preliminary development scheme should be used by the Wyoming Water Development Commission (WWDC) to continue consultation and collaboration with the U.S. Forest Service (USFS), Wyoming Game and Fish (WGF), as well as the Bureau of Land Management (BLM), and other federal and state agencies that will be involved with the Environmental Impact Statement evaluation process.

The trans-basin diversion scheme shown on Figure 1, provides for three major components:

- The Alignment A Collector System
- Fish Creek Dam and Reservoir
- A tunnel and pipeline from Fish Creek Reservoir to the North Platte River near Overland Crossing

Yields for the collector alignment used in the Stone & Webster Engineering Corp. 1984 Technical Summary Report (SWEC 84), were substantially reduced after incorporating the recommendations of USFS and WGF presented to WWDC in 1984. Further consultation and discussions by WWDC during 1985 modified the estimated yields and resulted in a potential average annual yield before pipeline constraints of 33,700 acre-feet. By examining alternative routes and design approaches, SWEC developed a collector alignment which increased the estimated yield to about 41,000 acre-feet without constraints and approximately 39,000 acre-feet when considering pipeline constraints.
The proposed collector (Alignment A) not only improves the water yield of the system, but eliminates some of the fishery stream crossings and shortens the main pipeline route for the collector. The collector system is the most critical element in the overall design requirements of the Fish Creek Collection System.

The Fish Creek Dam site at the confluence of Fish Creek and the North Fork Savery Creek is the preferred dam location. Both a central core embankment and a concrete face rockfill dam appear feasible and should be studied further. The concrete face rockfill dam is currently preferred due to the availability of borrow and less weather constraints during construction.

The tunnel from the Fish Creek Reservoir to Trapper Creek is based upon very little subsurface on-site geotechnical information. Therefore, its design as an access route across the Continental Divide for the pipeline is conservative from a cost viewpoint. Future subsurface explorations may indicate that a smaller hydraulic pressure tunnel is feasible and more economical.

The proposed conveyance pipeline to the North Platte River will be buried. It can be constructed in a relatively short time due to its simple design, even though it is relatively long. Refinements of the overall system operating plan will establish final design criteria for the conveyance pipeline.

**Recommendations**

Based upon the results of the Fish Creek Collection System studies to date, the following recommendations are submitted:

1. The Alignment A collector route should be presented and discussed with the USFS and WGF. Following this a final proposed alignment should be adopted.
2. Operation studies to determine final reservoir sizing should be conducted and be based on the yield of the proposed final collector alignment.

3. A limited geotechnical field exploration program should be initiated along the proposed tunnel alignment and in the vicinity of the Fish Creek Dam to determine the preferred dam type.

4. The evaluation and steps necessary to initiate the EIS permitting process should be pursued.
INTRODUCTION

The Fish Creek Collection System is a multi-purpose water supply system which is intended to utilize a portion of Wyoming’s entitlement to water in the Little Snake River Basin under the provisions of the Upper Colorado River Basin Compact of 1948 (W.S. 41-42-401). Article XI of the Compact apportions water of the Little Snake River between Colorado and Wyoming.

The project is located in south central Wyoming in Carbon County. The project will collect water from the west facing mountain slope of the Sierra Madre Range and transport it north by gravity pipeline to a storage reservoir on the North Fork of Savery Creek near the Continental Divide. From the storage reservoir, water will be gradually released across the Continental Divide via tunnel and pipeline to the North Platte River near Overland Crossing, north of Saratoga.

This Interim Concept Design report presents the development of the trans-basin diversion scheme which has taken place during 1985 and 1986. Because of its location in large part within a controlled forest area and because by its nature its intimate involvement with every water course and every stream within the project boundaries, environmental concerns and impacts will play an important part in the ultimate development of the project. This report presents a proposed development scheme which can be used to address the impacts resulting from these concerns. Continued study and development will need to be carried out by the Wyoming Water Development Commission in concert with involved federal and state public agencies, with emphasis placed on needs, benefits and costs of the project before a Final Concept Design can be completed.

Project Authorization

The Wyoming Legislature in its 1985 Session authorized the Wyoming Water Development Commission to conduct a Level III Phase I Concept Design of the Fish Creek Collection System Project. The project as outlined by House Bill 245 required an Interim Phase I Concept Design Report be provided to
the WWDC by November 1, 1986. A final report, which is to cover consideration of the necessary activities associated with the Environmental Impact Statement, is to be provided to WWDC by November 1, 1989.

Stone and Webster Engineering Corporation (SWEC) in contract with the WWDC for Engineering services dated April 15, 1985, was commissioned to conduct the required Level III Phase I activities. SWEC retained the firms of Western Water Consultants Inc. (WWC) of Laramie, Wyoming and Robert Jack Smith and Associates (RJS) of Rawlins, Wyoming to collaborate in this study work.

The first task of the 1985 study work was to evaluate the impacts on the Collector System yields based upon preliminary reports by the Wyoming Game and Fish (WGF) and U.S. Forest Service (USFS). Once assessment of the potential ramifications of the WGF and USFS reports were completed, WWDC conducted coordination meetings to clarify issues and determine a reasonable process for estimating potential water yields from the collector area. Following this activity, the development of project features was initiated.

This Interim Phase I Concept Design Report presents the findings and results of the studies to date, considering anticipated requirements of the WGF and USFS on available water yields and preliminary conceptual designs for the various project features.
PROJECT COMPONENTS

The Fish Creek Collection System is a trans-basin development scheme which will allow water from the Little Snake River Basin in Carbon County, Wyoming to be collected, stored, transported, and finally released into the North Platte River in the vicinity of Overland Crossing, just north of Saratoga.

The basic elements of the scheme are threefold:
1. Collector System
2. Fish Creek Dam and Reservoir
3. Transmission System

The collector is comprised of a series of instream and side hill collector facilities which will be sized and designed to collect portions of the available water from their respective contributing drainage areas, as well as by-passing water for instream fishery flows, flushing and channel maintenance flows. The various collectors direct the divertable flows from the collector area into a pipeline which will convey the water by gravity to the Fish Creek Reservoir.

The proposed Fish Creek Dam is located on the North Fork of Savery Creek just downstream of the confluence of Fish Creek and the North Fork Savery Creek. The road between Rawlins and the Encampment Highway (Wyoming Route 71) crosses the North Fork Savery Creek just upstream of the confluence. The reservoir formed by the dam will store the water from the collector for gradual year round release to the North Platte Drainage. A conservation pool will be maintained below the reservoir live storage used for trans-basin diversion, and natural flows into Savery Creek will be released through the low level outlet. An emergency spillway will be provided.
In order to deliver the water stored in Fish Creek Reservoir to the North Platte River system, a pipeline will pass through a tunnel beneath the Continental Divide and then follow Trapper Creek and Sage Creek to reach the North Platte River in the vicinity of Overland Crossing. The possible development of hydropower from the pipeline transmission system has been considered.

The WWDC requested that the Interim Conceptual Design for the Dam and Transmission System be consistent with that of the Collector System, resulting in a design based on less rigorous studies than would normally be used. This was due to the limited accuracy of topographic data available for the collector area, and the estimates of water yields which might be expected with various alignment alternatives, given the U.S. Forest Service (USFS) and Wyoming Game & Fish (WGF) flow considerations and hydraulic constraints of the collector pipeline system. Consequently, no geotechnical exploratory program at the dam site or along the collector alignment was included in this study phase. The need for access agreements for exploratory field work was therefore eliminated, and only limited survey, geologic mapping and visual reconnaissance was necessary.

COLLECTOR SYSTEM

Design of the collector system for the proposed Fish Creek Collection System has developed from the Cheyenne Stage I and II Systems. The Stage I portion was constructed in the early 1960's and Stage II is now in the final stages of being completed. In the early period of development by the WWDC, the Stage III portion, now called the Collector System, was proposed to start at the Battle Creek area and flow northward to a tunnel which would empty into Jack Creek on the east slope of the divide. This plan was found to be environmentally unacceptable. Two other routes were examined in WWDC studies; a gravity system over the Continental Divide, and a gravity system emptying into a reservoir on the west slope of the Divide. In it's Technical Summary Report of November 1984, SWEC presented the collector emptying into the west slope reservoir (Fish Creek Reservoir) as
the preferred trans-basin scheme for initial development. The 1984 collector route is referred to herein as Alignment SWEC-84.

It should be kept in mind, that while the Collector System has benefited from the construction and design experience of the Stage I and II developments, the topographic data from the 40 foot contours of the USGS quadrangle maps is quite approximate. Ultimately, ground surveys will be required to establish a reasonably accurate collector alignment which can be referenced to points on the ground surface. This survey work in the Medicine Bow National Forest must await approval for this action from the U.S. Forest Service (USFS). General agreement with USFS as to the scope and intent of the Fish Creek Collection System will be necessary prior to obtaining authorization to do detailed surveying.

Collector Yields

The first step in this study phase of the Fish Creek Collection System was a reevaluation of the collector yields. In December 1984 the USFS provided the WWDC with their request for channel maintenance flow bypasses for streams to be affected by the Fish Creek Collector. The USFS document specifically stated that their requests were for channel maintenance only and did not include flows for any other purpose (such as fisheries). Channel maintenance flows requested by the USFS included base flow, rise/recede, and flushing (bankfull) components which, in total, provided for a bypass of 53 percent of all flows. Also in December 1984 WGF personnel provided the WWDC with their request for stream flows in the Fish Creek Collector area. The WGF request included an instream fisheries flow of 34 percent of the average daily flow (ADF) (or the natural flow, whichever is less) for fishery streams and "no development" of those streams with populations of Colorado River Cutthroat trout.
In the fall of 1985, field work was undertaken by SWEC and Western Water Consultants (WWC) as part of the study assessing channel maintenance flow requirements. The field work resulted in part, in revised estimates of the unaltered (virgin) yield to the collector system. The revisions were due to: 1) changes made by the USGS in gage drainage areas, and 2) onsite review of the topographic, vegetative and stream channel characteristics of the Fish Creek collector area.

In December 1985, WGF provided the WWDC with another report in response to a WWDC request to rank the previously identified "no development" streams. In early 1986, SWEC and WWC performed several studies to assess the effects of USFS and WGF recommendations. After much discussion and consideration of Agency requests, the WWDC adopted operating criteria which would likely be imposed if the system were constructed. These criteria were then included in the computer model of the collector system. Specifically, these criteria included:

- For fishery streams, bypass an amount equal to designated instream flows as requested by the WGF, up to a maximum of 50 percent of the average daily flow.

- Bypass annually on fishery streams, a 3-day flushing flow equal to the USFS determined "bankfull" flow amount.

- Retain prior rights considerations as previously modeled.

- There would be "No development" or no collection from the eight highest priority cutthroat streams as set forth by the WGF or from sidehill collectors immediately tributary thereto.

- Other sidehill collectors would be operated as previously modeled.
The yield without pipeline constraints of the SWEC 84 collector alignment resulted in the following values:

<table>
<thead>
<tr>
<th>SWEC '84 Collector Alignment</th>
<th>Estimated Average Annual Yield in Acre-Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin Flows</td>
<td>56,483</td>
</tr>
<tr>
<td>Virgin Minus Prior Rights</td>
<td>50,292</td>
</tr>
<tr>
<td>Virgin Minus Bypass Criteria</td>
<td>33,730</td>
</tr>
</tbody>
</table>

Once the analysis identified that adequate water yield could be expected from the SWEC '84 collection system, the WWDC authorized the initiation of the preliminary conceptual design. The basic approach in refining the collector alignment, was to locate it at a lower elevation than had been proposed in earlier studies. This routes the pipeline through more reasonable terrain where side slopes tend to be less steep, particularly in the Battle Creek or upstream area. At lower elevations contributing drainage area is increased and provides a potentially larger total yield. However, this also tends to increase the length of the collector pipeline. The objective of investigating lower alignments was to determine whether an increased yield justified increasing the pipeline length.

The evaluation of lower alignments resulted in development of Alignment A shown on Figure 2. Alignment A is lower in elevation than the SWEC-84 alignment in the Battle Creek to Sandstone Creek watersheds where approximately 87 percent of the total system yield is derived. Thus, increased collector drainage areas resulted in beneficial increase in yield. Other adjustments were included in Alignment A to improve the route. Inverted siphons were used at Lost Creek, Haggarty Creek, Big Sandstone Creek, Dirtyman Fork, East Fork Savery Creek, Hatch Creek, Hartt Creek, and Deep Gulch. This significantly reduces the main collector pipeline length, while avoiding more difficult terrain in side drainage basins. This is particularly beneficial at Haggarty and Big Sandstone Creeks where large lengths of main collector pipeline can be deleted. Yet,
beneficial yields on these two drainages are collected using smaller spur lines as shown on Figure 2. About 42 percent of the total system yield is collected with these two spur lines.

Alignment A crosses fewer headwater drainages and has fewer instream collectors since it is at a lower elevation. Thus, the number of cutthroat trout streams to be impacted is less and the potential for construction-related instream flow disturbances is less.

The yield without pipeline constraints of the Alignment A Collector, resulted in the following values:

<table>
<thead>
<tr>
<th>Collector Alignment A</th>
<th>Estimated Average Annual Yield in Acre-Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virgin Flows</td>
<td>62,264</td>
</tr>
<tr>
<td>Virgin Minus Prior Rights</td>
<td>55,536</td>
</tr>
<tr>
<td>Virgin Minus Bypass Criteria</td>
<td>41,022</td>
</tr>
</tbody>
</table>

This represents an improvement in the amount of collectable water from the revised alignment of approximately 20 percent.

Collector Design

The collector system conceptual design is envisioned as a buried pipeline following the hillside contours with a pipeful flow regime. Inflow to the pipeline is through inlets located at intercepted streams and along the road to catch hillside runoff. Inflows are based on the available divertible flows defined by the WWDC criteria. These available flows were adjusted to estimate actual collectible yield within the constraints of the collector layout and sizing. Pipeline design flows were defined as 1.5 times the average daily June runoff available for diversion. The next level of conceptual studies of the collector system should review this design criteria, to identify possible reductions in pipe size and thus in pipeline cost. The slope of the collector pipeline directly affects pipe
size. At flatter slopes, a larger pipe is required to convey a given flow. Conversely, steeper profile slopes allow the use of smaller pipes. In general, the pipeline layout has an alignment following natural contours at a relatively flat profile. Consideration was given to steeper profiles in the downstream section in the Savery Creek drainage.

Pipe sizes and lengths were defined on the basis of a sizing rule. Six-inch increments in pipe diameter were used. The pipe was sized for pipeful flow ranging to slightly pressurized flow until the cumulative flow dictates the next largest pipe diameter.

Where inverted siphons are used at cross drainages, relatively high pressure flow occurs. This allows pipe diameters to be decreased. At the larger drainages, the available water is collected using a spur line running on contour into the watershed to a point of intersection with the stream.

The collector structures for controlling water captured by the collector pipeline vary with location and design inflows. The preliminary conceptual layout for instream structures is considered to be similar to that used for structures in the Stage II Little Snake Diversion Pipeline. Each instream structure will be individually sized. Sidehill collectors will all be "drain" type components of sufficient number to cover each sidehill length.

The estimated average annual yield for the Alignment A system with pipeline constraints is 39,000 AF. Sixty five percent of the total yield is from the Battle Creek drainage, twenty-two percent from the Sandstone Creek drainage, and only thirteen percent from the Upper Savery drainage.

Comparative cost estimates for the collector pipe only, are $70.3 million for Alignment SWEC-84 and $60.3 million for Alignment A. The overall pipeline length for Alignment A is shorter since appropriate siphons have been used. This shorter length and the use of smaller diameter pipe results in a savings of approximately $10 million.
In evaluating the collector system for the present study effort the emphasis was on refinement of the pipeline alignment and hydraulics. However, the collector system yield is not yet firm because bypass flows for Alignment A are subject to future review by USFS and WGF. Although a preferred concept of development is identified for the collector system, the final pipeline scheme and system yield could be modified further.

The collector system includes instream and sidehill collectors. These features are assumed to be conceptually the same as used in the Stage II diversion pipeline. Detailed work on individual collector facilities was not done for this study, but it is estimated that the cost of all collector facilities is only about 6 percent of the total pipeline system.

The foundation conditions along the collector system alignment are generally favorable. It is estimated that rock will be at or near the ground surface along about 50 to 75 percent of the alignment. Significant rock blasting is anticipated. No subsurface investigations have been performed to date, but should be conducted during the study phase when access has been authorized by USFS. Investigations will concentrate on evaluating the depth to rock and the geotechnical conditions in the landslide, talus, boggy and stream crossing areas.
FISH CREEK DAM AND RESERVOIR

The Fish Creek Dam and Reservoir arrangement is further developed in this study and is shown on Figure 3. Three alternative types of dam were technically and economically evaluated. In accordance with the scope of work for the Interim Concept Report, the studies were limited to using the available field information developed in the Rollins, Brown and Gunnell (RBG) 1984 investigation. Additional field studies will be necessary in order to refine the interim report concepts.

Geotechnical Information

The dam foundation at the proposed site was investigated by RBG. The investigation included seven borings, five on the axis of the dam, one upstream of the dam axis and one downstream of the dam axis.

The maximum depth of overburden found in the valley bottom is about 15 feet. No tests were run to evaluate rock strength, but the rock is believed to be relatively weak and poorly cemented. The bedrock appears to be at or within a few feet of the surface on most of the abutment slopes. The coefficient of permeability of the sandstone, as measured in the borings ranged from $8 \times 10^{-6}$ cm/sec to $1 \times 10^{-3}$ cm/sec. The permeability of the bedrock near the dam could pose a potential leakage.

The bedrock in the reservoir is described by RBG as a calcareous and limey fine grain sandstone. A few layers of limestone were found. Boring T-2 identified some small solution holes. The presence of limestone and calcareous conditions raises the potential concern about adequate reservoir tightness. However, the field surface reconnaissance did not identify any sink holes or signs of significant solutioning. Water levels measured in the borings suggest that the groundwater level may be relatively high in the reservoir rim.
FIGURE 3

WYOMING WATER DEVELOPMENT COMMISSION
FISH CREEK COLLECTION SYSTEM
FISH CREEK DAM AND RESERVOIR
GENERAL ARRANGEMENT

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RBG excavated a series of test pits during its borrow study. The groundwater elevations measured in the test pits showed a relatively high groundwater table at significant distance from the stream bed which would indicate that water was flowing towards the creek. These condition indicates that the bedrock is not highly pervious.

On the basis of the conditions discussed above, it is believed that the reservoir should be reasonably water tight and leakage should be acceptable. Further investigation is needed to confirm this belief and to permit a reasonable estimate of the possible seepage from the reservoir.

No evidence of slope instability was noted in the reservoir area and bank slides are not considered to be a major concern.

**Borrow Materials**

Impervious material suitable for use as core material was only found in test pit Area 6, the cirque area along the south rim of the reservoir which extends for about only a mile. RBG estimates the volume of material available from this area to be at least 150,000 cubic yards. The test pits show a 5 to 10 foot depth of sands and gravels in the valley bottom. The sands and gravels are typically of harder rock from the Sierre Madre and are expected to be suitable, with processing, for filter/drain material and concrete aggregate.

Sandstone bedrock is very close to the surface in the dam area; however, the sandstone would provide a poor quality rockfill. It is expected that the weak sandstone would break down excessively on excavating and placement and would not be suitable for riprap or for a good quality rockfill. The field reconnaissance suggests that harder, better quality metasedimentary/igneous rockfill can be obtained from the Sierra Madre complex located 2 to 3 miles south of the site.

Further investigation is required to evaluate the availability and suitability of the borrow materials.
Flood Analysis

A flood frequency analysis was conducted to determine the magnitude of peak flows which historically have occurred at the Fish Creek Dam site. For the recurrence interval of 10 years, an estimated peak discharge of 1,100 cfs was obtained, and for a 100 year interval, 2,000 cfs.

The recommended inflow design flood for Fish Creek Reservoir is the combination of the maximized snowmelt flood and the probable maximum precipitation induced flood. This combination results in a peak inflow to the reservoir of about 21,600 cfs with a volume of 15,000 acre-feet.

Reservoir Sedimentation

No suspended or bedload sediment discharge measurements have been made at the Fish Creek damsite. Therefore, data available at locations lower in the Savery Creek basin were used. The average annual sediment inflow was estimated to be 96 acre-feet over a 100-year period. Therefore, no specific action to mitigate the effects of sediment are considered necessary.

Reservoir Sizing

The Fish Creek Reservoir will be sized to regulate, through an annual cycle, the inflow from the mountain side collector system and the Fish Creek Reservoir drainage. Reservoir releases will supply monthly municipal and industrial demands of North Platte River water consumers as well as specified minimum releases to Savery Creek. The dam is equipped with a spillway to assure its safety in case of emergencies and a low level outlet to enable Savery Creek releases. Since the sole purpose of the Fish Creek Dam will be to impound water for diversion to the North Platte River, only minimum releases up to natural inflow rates and emergency spillway discharges are expected to be released into the North Fork of Savery Creek.
Although no long term reservoir operation studies have been conducted, a sample one year reservoir routing has been carried out using the yields from the proposed new collector Alignment "A". The reservoir functioned within the limits, i.e. within the live storage boundaries (35,200 acre-feet) between the conservation pool and the surcharge flood storage pool. Operation studies to firm up the reservoir sizing should be conducted when estimates on collector yields from Alignment A have been reviewed with USFS and WGF.

The low level outlet will serve multiple functions and has been tentatively sized to meet the Corps of Engineers latest design criteria regarding emergency evacuation of the reservoir. The low level outlet is controlled by a valve at the downstream end which can facilitate releasing small discharges to Savery Creek for minimum environmental demands.

The dam is protected against overtopping by the emergency spillway. This spillway is sized so that, in conjunction with flood surcharge storage it safely passes the probable maximum flood (PMF) to the North Fork Savery Creek.

Alternatives Studied

Three alternative dam site locations and three alternative dam designs were evaluated. Based on the dam size and the length of water transmission system across the Continental Divide required for each of the three sites considered, the site located 500 feet downstream of the confluence of Fish Creek and North Fork Savery Creek studied in the 1984 RBG Investigation is preferred.

The estimated cost of the central core embankment dam and the concrete face rockfill dam are about the same. Both dam types are technically feasible based on the current level of study. For this Interim Concept Design Report these two dam types are recommended for further study. Preliminary conceptual design layouts for the central core embankment dam are shown on
Figure 4, and on Figure 5 the concrete face rockfill dam. The concrete face rockfill dam is currently preferred since there are less concerns about the availability of suitable construction material and weather impacts on constructability.

Geotechnical field studies of the foundation conditions at the dam site, available borrow sources, and investigation of the reservoir area should be conducted before establishing the preferred dam type.

TRANSMISSION SYSTEM

The Transmission System has two principal components: a 17,000 foot long tunnel from the Fish Creek reservoir under the Continental Divide to its outlet on Trapper Creek, and 24 miles of pipeline from the tunnel intake to the pipeline outlet at the North Platte River near Overland Crossing (see Figure 6). The pipeline follows Sage Creek along most of its length and is designed for the incorporation of possible future hydropower about 5 miles below the tunnel exit.

Tunnel

Connecting the pressurized Sage Creek transmission pipeline directly to the Fish Creek Reservoir, removes the need for any stretch of open channel flow (balancing pool) and thereby changes the control of the hydraulic system from the upstream end to the discharge end of the pipeline. The use of an open tunnel with an accessible pressure pipe through it is considered the more positive, lower risk alternative for this Interim Concept Design Study and has been chosen for further consideration. Because of the lack of subsurface information on rock and groundwater conditions along the tunnel alignment, it is not considered currently feasible to identify the necessary conceptual design details for the satisfactory performance of a pressure tunnel. When the subsurface data becomes available, the pressure tunnel alternative should be further evaluated.
ADAMS RESERVOIR

FISH CREEK RESERVOIR

POSSIBLE FUTURE HYDROPOWER PLANT

SAGE CREEK TO NORTH PLATTE PIPELINE

KINDT RESERVOIR

FISH CREEK GRAVITY LINE

SAGE CREEK

OVERLAND CROSSING

FIGURE 4

WYOMING WATER DEVELOPMENT COMMISSION
FISH CREEK COLLECTION SYSTEM
TRANSMISSION SYSTEM PLAN

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The buried transmission pipeline from the tunnel outlet on Trapper Creek to the North Platte River follows Sage Creek along almost its entire length, hence the name Sage Creek Pipeline, to a point on the North Platte River just north of Overland Crossing (See Figure 6). This is the most direct route and makes maximum use of existing roads. The route has been inspected on the ground and from the air and studied from aerial photos. The length of the pipeline from the tunnel exit is 21 miles. The pipeline material has been selected, at this stage, as high pressure concrete, cylinder pipe. This rugged pipe type can be designed to withstand high pressure, possible heavy external loading and is resistant to corrosive and erosive attack. When the final yield of the collector system and results of the reservoir operation studies have been completed, a final evaluation of the tunnel with its gravity flow versus a pumping scheme should be conducted to confirm this proposed scheme.
HYDROPOWER INVESTIGATION

Hydropower potential for the Fish Creek Project was evaluated at four locations: the dam outlet works to Fish Creek; the tunnel outlet works to Trapper Creek in the Sage Creek drainage; and at two drops in the Sage Creek Pipeline. The Fish Creek outlet potential was quickly dismissed due to insufficient flow; the standard release to Fish Creek will be from 4 to 10 cfs minimum stream flow requirement. Of the other three potential sites only the first drop in the Sage Creek pipeline appears to have some future potential.

The power potential at the first drop could lead to the development of about 3.8 MW at a present day cost of about $9.5 million, or $2,500 per KW. This is marginally high for a part of the country currently enjoying a power surplus, but the present situation will not always prevail and this hydro plant could prove feasible in the future. Further operation studies of the Fish Creek Reservoir are needed to determine the firm KW capacity of the plant.
PERMITS AND LAND ACQUISITION

The State of Wyoming has filed water rights applications for the Fish Creek Reservoir and Collector System. No other permit applications have been submitted to date.

The proposed Fish Creek Project will be subject to a full federal Environmental Impact Statement (EIS) Process. The U.S. Forest Service is expected to be designated as the lead federal agency responsible for completion of the EIS. It should be noted that authorization will have to be obtained from the Forest Service to conduct any field activities beyond reconnaissance level observations. The proposed reservoir, collector and pipeline locations will also have to be surveyed by a qualified archaeologist as a part of the State Historic Preservation Officer (SHPO) Cultural Resource Clearance.

Land acquisition requests for the Fish Creek Collection System are different for each of the major components of the project. The collector system is located primarily in the Medicine Bow Forest and will require permitting by the U.S. Forest Service. In the northern sector of the collector, which is outside the Forest Boundary, an easement for the right of way will need to be obtained from private owners and the Bureau of Land Management (BLM).

The dam and reservoir area will require purchase of property within the inundated zones as well as along road relocation routes. The tunnel and pipeline route from the Fish Creek Reservoir will be served best by right of way easements which will involve private as well as BLM Lands. Figure 7 is a map showing ownership of property in the vicinity of the Fish Creek Dam and Reservoir.

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SYSTEM COST ESTIMATE

The conceptual order of magnitude cost estimate for construction of the recommended Fish Creek Collection System is summarized below:

<table>
<thead>
<tr>
<th>Component</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector System</td>
<td>$91,000,000</td>
</tr>
<tr>
<td>Fish Creek Dam and Reservoir</td>
<td>33,000,000</td>
</tr>
<tr>
<td>Transmission System</td>
<td>80,000,000</td>
</tr>
<tr>
<td><strong>TOTAL ESTIMATED COST</strong></td>
<td><strong>$204,000,000</strong></td>
</tr>
</tbody>
</table>

The estimate is based on quantities developed from the interim conceptual designs and present day 1986 unit prices. Allowances of 15% for engineering and construction management, and 15% for indeterminates have been included to complete the estimate.

The interim estimated cost of $204,000,000 is approximately 20 percent higher than costs estimated in the SWEC 1984 Technical Summary Report. This is primarily attributed to escalation, and the increased costs of design improvements to the transmission tunnel system from Fish Creek Reservoir to the Sage Creek Basin. The improved tunnel system consists of modifying the open channel flow tunnel configuration to a pressurized system with a 48-inch diameter pressure pipe within an access tunnel. Evaluation resulted in a 4000 foot (30%) tunnel length increase and a 2-foot diameter increase.
PROJECT SCHEDULE

With the preliminary concept design of the collector system limited by the lack of accurate topographic data and site access, it was considered prudent by the WWDC, to also limit field geotechnical exploration for the Fish Creek Dam to surface observations, until better definition of yields, alignment and costs could be studied. With the completion of the Interim Concept Design Report, scheduling of the National Environmental Policy Act (NEPA) review process should be initiated. This will allow the suggested third party EIS process to begin in the spring of 1987 and necessary baseline data gathering to be initiated. Discussions with WGF and USFS regarding the proposed Alignment A of the collector routing should result in a firmer definition of anticipated collector yields. As shown on the proposed schedule Figure 8, the EIS process is estimated to take 30 months.

To satisfy an adequate definition of the design requirements of the Fish Creek Dam, as well as the tunnel to Trapper Creek, a preliminary geotechnical exploration program will be necessary to complete the Conceptual Design of the structures. This work is shown on the proposed schedule beginning in the spring of 1987.

Continuation of this Conceptual Design activity is shown into 1988, and reflects possible design developments which result from environmental assessments being conducted during the EIS process. The completion of the conceptual designs for the collector, dam and reservoir and transmission system must be scheduled to allow adequate review under the EIS process. Sufficient timing should be allowed so that all significant concerns are adequately addressed and evaluated before the proposed development is presented to the 1990 Legislative Session.

If immediate development of the project is directed by the Legislature in 1990, final design could begin in 1990 and be followed by construction beginning in 1991. The preliminary estimate of the period required for construction of the project is five years. Careful planning to carry out
FIGURE 8

WYOMING WATER DEVELOPMENT COMMISSION

FISH CREEK COLLECTION SYSTEM

PROPOSED PROJECT SCHEDULE

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the work at several locations simultaneously, will be necessary to accomplish the project in this time frame. The project will need to be essentially complete in all aspects before significant water will be available for trans-basin diversion. Due to the nature of the project, construction staging opportunities are considered to be very limited and of questionable benefit. Therefore, the earliest that utilization of water from the project could occur is 1996. Extension of the schedule due to permitting, institutional or unforeseen legal delays should be monitored by WWDC as the project develops.