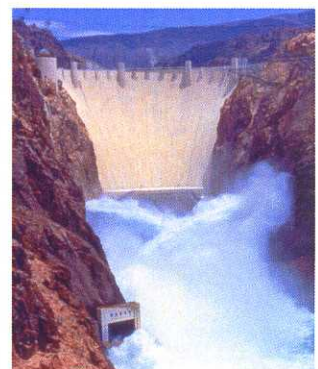
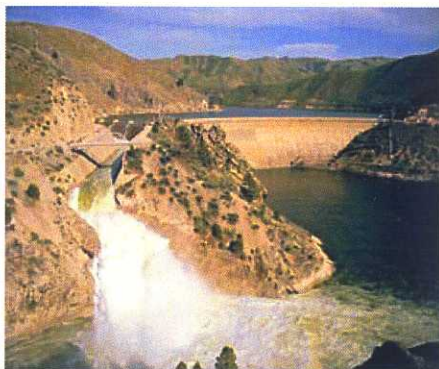


# RECLAMATION

*Managing Water in the West*

*Report DSO-05-02*

## Spillway, Outlet Works, and Water Conveyance Structure Needs—Survey Results



*Dam Safety Technology Development Program*



U.S. Department of the Interior  
Bureau of Reclamation  
Technical Service Center  
Denver, Colorado

December 2005

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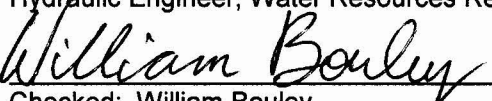
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**Report DSO-05-02**

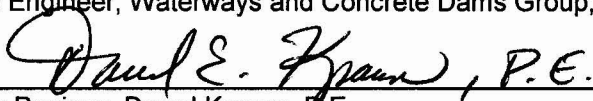
**Spillway, Outlet Works, and Water  
Conveyance Structure Needs  
Survey Results**

**Dam Safety Technology Development Program**  
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## **Mission Statements**

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

# Acknowledgments

Funding for this project was provided wholly from Reclamation's Science and Technology Program in FY03 and FY04. Funding was provided jointly by the Science and Technology Program and the Dam Safety Research Program in FY05.

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The author would like to acknowledge the survey respondents for taking the time to fill out the survey and supply additional comments.

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# Executive Summary

This report is the result of the research project called Evaluation and Innovative Solutions to Reclamation Spillway and Water Conveyance Structure Needs. The goal of the research project was to define common problems with Reclamation's hydraulic structures and determine potentially innovative and cost-effective solutions to the identified needs. This report summarizes the results of the survey that was conducted under the research project. In addition, the report summarizes some of the repairs underway on specific projects and provides ideas for future research beyond the scope and funding level of this project.

Some common concerns throughout Reclamation's aging infrastructure are clearly in need of attention. The survey respondents are clearly interested in addressing these concerns to ensure performance of the structures under their responsibility. In that respect, this survey has been of value. The broad-based attempt was to identify specific areas of concern and address them; however, this was considered to be too significant for this team to effectively accomplish in the time allotted.

The major issues related to concrete condition and repair, stilling basin abrasion, and identifying issues with nonreinforced slabs on spillways are currently being addressed by research programs.

The results of the survey are summarized here.

The top structural issues identified with spillway and outlet works structures that are not being addressed by research studies were:

- Deterioration of gates and surfaces surrounding gates probably caused by high velocity flow and cavitation and operation of gates by wire ropes or chains
- Erosion in the channels downstream from the energy dissipation structures or the release points of the structures
  - This may include enlargement of plunge pools formed by releases.

The top structural issues identified with conveyance structures that are not currently being addressed by research studies were:

- Canal issues are more important than pipeline issues.
- Canal linings

- Cross drainages
- Siphons

The top observations and factors causing the structural concerns not currently being addressed were identified as:

- Foundation issues causing movement of concrete linings and/or failure in spillways and conveyance canals
- Drains blocked or not functioning
- Seepage and groundwater problems
- Submerged structures
- Gate binding
- High velocity flow causing many issues

## Future Tactic

Any of the issues identified in the survey could be followed up on with future **specific** research projects. Future attempts to address Reclamation's aging infrastructure should separate the conveyance structures, such as canals, pipelines, and siphons, from the spillways and outlet works.

The consensus of the team was that this project was a worthwhile effort; however, the ability to address all the issues was limited. Coordination of an effort like this definitely needs a centralized Reclamation point of contact. Broad-based support has successfully been developed for certain aspects of structure rehabilitation and/or repairs, namely concrete repair, stilling basin deflectors, and just recently investigation of spillway slab uplift pressures, but many of these efforts have taken years of planning and major failures to obtain a meaningful commitment.

This project could be continued in the future by tracking issues with an active database and point of contact within the Technical Service Center (TSC) that have support, funding, and management cooperation.

Being able to effectively query a database, or potentially adding this capability to the Dam Safety Information System (DSIS) database, would be extremely beneficial for future similar endeavors.

## Introduction

The need to maintain Reclamation's hydraulic infrastructure is now perhaps more important than ever as continuing and additional demands are being placed on an aging system. These demands require providing for water system storage, delivery, flood passage, and environmental flows, in an era of tight budgets. The research was undertaken to determine the needs of our aging hydraulic structures and to innovatively and cost effectively provide solutions to continue meeting the mission-related activities of our agency.

The research project name is Evaluation and Innovative Solutions to Reclamation Spillway and Water Conveyance Structure Needs. It was assigned project number 429 under the Science and Technology Program. The project began in fiscal year 2003, was minimally funded in fiscal year 2004, and was completed in fiscal year 2005. The project scope was modified during fiscal year 2005 to include only the survey and reporting of the spillway, outlet works, and conveyance structures within Reclamation projects. In addition, a brief summary of repair techniques currently being utilized on several key projects is given.

## Research Objective

The objective of this research program was two-fold:

- To identify the areas of Reclamation's hydraulic structure infrastructure that were determined by field operating personnel to be of most concern and to prioritize them based upon need
- To identify potential innovative and cost-effective methods to address these areas

Workload and funding levels have not permitted the followup anticipated under the work plan, and the survey results are published here with current repair techniques and costs outlined for some projects currently under repair.

## Team Members

The team members for this project, listed in table 1, were selected based upon their expertise and knowledge in fields related to spillways, outlet works and conveyance structure design, inspection, maintenance, and operation. Each member provided valuable elements to the project.

**Table 1.**—Team members for the project

Team member*	Name	Mail code	Phone	Email
Kathy Frizell	Research Hydraulic Engineer	D-8560	303-445-2144	kfrizell@do.usbr.gov
Elisabeth Cohen	Civil Engineer	D-8130	303-445-3247	bcohen@do.usbr.gov
Steve Robertson	Civil Engineer	D-8140	303-445-3123	srobertson@do.usbr.gov
Darrel Krause	Program Analyst	D-5700	303-445-2941	dkrause@do.usbr.gov
Bill Bouley	Civil Engineer	D-8470	303-445-2754	wbouley@do.usbr.gov

\*Todd Hill was added for the 2005 work, but was really not utilized as reporting of previous survey results was the only task accomplished in the year.

Other experts within the Technical Service Center (TSC) were consulted throughout the project including; Jay Swihart, David Harris, and Kurt VonFay, all from mail code D-8180, the Materials Engineering and Research Laboratory Group.

## Methods

The following discussion outlines the way the team approached the project. The initial meetings were to determine how to best utilize the skills of the various team members and to identify more clearly the scope and goals of the project. The initial focus was then to determine what type of project information to gather and the most efficient manner to obtain the information.

## Scope

The research project was initially very broad based. The task of the team was to determine how to obtain the information needed from the enormous number of projects across Reclamation. Several meetings were held as the team defined the scope of the project and the best way to obtain the information needed about the projects. The following list defined the scope and tasks:

- *Infrastructure focus only.*—Not operational unless changes in operation or volumes are dictating physical rehabilitation or upgrades to the structures. Only hydraulic issues leading to failures or an inability to convey water and/or structural issues that cause hydraulic forces that lead to failures would be investigated.

- Outlet works structures would be added to the investigation, in spite of the project name only including spillways and conveyance structures.
- Obtain information needed about Reclamation spillways, outlet works, and conveyance structures
  - How to obtain—through travel, survey either phone, email, written
  - Develop a survey or questionnaire
- Analyze, prioritize, and document survey results
  - Identify sites with most promise for demonstration projects and partnerships
- Develop potential solutions to problems by analysis techniques, laboratory modeling, or field demonstrations.
  - Develop out-year proposals to conduct research of the potential solutions and demonstration of solutions at projects. (This portion of the project was never funded.)

## Information Gathering

The task of obtaining the information needed on the projects was undertaken once all team members understood the task well. Information would be obtained on the projects by accomplishing the following tasks:

- Determine the information needed about the structures
- Investigate existing internal databases and reports to make sure the information was not already available
- Develop a survey or questionnaire to supplement existing data, if available
- Send out the survey with deadlines for return
- Analyze survey results looking for common problems and willingness of project personnel to use their sites for demonstration of potential solutions
- Prioritize problems and obtain further specific project input by traveling to projects

Throughout Reclamation there are various databases and programs that deal with listing project structures, capacities, condition, etc. The team thought it best to review the existing information and determine if any of the publications or

databases could be easily queried to find out about common problems dealing with spillways, outlet works, or conveyance structures. The following list of publications, websites, and databases were reviewed for their potential application to this project. The full citations are given in the references.

- Reclamation pipeline survey R-94-12 *Historical Performance of Buried Water Pipe Lines*, 1994, partly funded by the Awwa Research Foundation [1].
- *Report from Facility Review Workshop—Research Needs*, 2001, from the 2001 Facility Review Workshop—performed rankings of infrastructure problems. Provided by David Harris [2].
- *Canal-Lining Demonstration Project, Year 10 Final Report*, R-02-03, November 2002 by Jay Swihart [3] or on the website: <http://www.usbr.gov/pn/programs/wat/programs/canal/index.html>
- *Use of Geomembranes in Bureau of Reclamation Canals, Reservoirs, and Dam Rehabilitation*, REC-95-01, December 1995 [4].
- *Statistical Compilation of Engineering Features on Bureau of Reclamation Projects*, 1992 (also in electronic format via the MS Access program) provided by Darrel Krause [5].
- Water O&M Bulletin and Index website: <http://www.usbr.gov/infrastr/waterbull/index.htm>
- DSIS website: <http://sodis.usbr.gov/dam%5Fsafety/documents.htm>. This website can be queried through Wade Feldman, the administrator.
- Copy of the Spillways and Outlet Works database proposal (referred to as Appendix A) provided by Elisabeth Cohen. This is a proposal to make an interactive database of spillway and outlet works statistics.
- Spreadsheet of Reclamation projects with the facility name, Region and Area Office locations, and the main contact for each project listed. This was provided in an Excel spreadsheet titled dams.xls by Bill Bouley.
- List of cavitation-related studies from the Water Resources Research Laboratory (WRRL) publications site provided by Kathy Frizell
- *Research on Abrasive Materials in Stilling Basins*, PAP-720, 1978 by Gene Zeigler, which included a survey of stilling basin abrasion [6].
- List of Regional/Area office contacts for survey mailing provided by Darrel Krause.

Unfortunately, upon review of these resources, the team felt that there was not going to be a way to obtain the needed information other than to inquire directly with the project personnel. Being able to effectively query some of these databases, in particular the DSIS database, would be extremely beneficial for future similar endeavors. Therefore, the process of developing a survey began.

## Survey

The team agreed the focus of the survey should be on hydraulic issues leading to failures or inability to convey water and/or structural issues that cause hydraulic forces that lead to failures.

Initially, a very detailed survey was thought to be needed. The team brainstormed issues of concern. A skeleton survey was developed with these issues listed for each Reclamation project listed separately from the dams.xls spreadsheet. Each contact person would have between 3 and 28 individual projects listed on the spreadsheet for response.

After reviewing the complexity of this initial skeleton survey, the team decided the best way to get responses from the field personnel was to develop a simple one-page questionnaire and developed a simplified list of important aspects of concern for each type of structure.

The team decided to separate the hydraulic structures under consideration into three categories; spillways, outlet works, and conveyance structures. Under each category, three questions were asked:

1. Given all the projects with spillway/outlet works/water conveyance features that you oversee, what features cause you the most trouble?
2. What do you observe that causes the concerns you stated for your spillway/outlet works/water conveyance structure features?
3. What do you suspect are major contributing factors that jeopardize your systems' ability to function?

Under each major question, about a dozen areas of concern were listed and respondents were asked to simply check the boxes that applied to their projects. Under question 1, the problem area concerns were different for spillways, outlet works, and conveyance structures. For example, under spillway structures, the projects were asked to check the three most problematic areas regarding crests, gates, chutes or tunnel inverts, piers/divider walls, training walls, flip buckets, stilling basins/plunge pools, drains, downstream outlet channels, foundations, or other. Under question 1 for the outlet works, the questions were similar except that the intake structure, pressurized conduit were added. Under question 1 for the conveyance structure were listed diversions or headworks, canals, canal

linings, pipelines, pumping plant intakes, pumping plant discharges, tunnels, siphons, underdrains, cross drainages, check structures, drop/dissipating structures, foundations, and other.

Under question 2, the areas listed were the same for each structure, and participants were asked to check all that applied: concrete cracking, slab movement or offsets, concrete deterioration, concrete abrasion/erosion, gate binding/malfunction, lack of flow through drains, inadequate capacity, inadequate control, bank sloughing, downstream channel erosion, failure of foundation or concrete, and other.

Under question 3, again the areas listed were the same for each structure and participants were asked to check all that applied: high velocity flow, high energy dissipation, concrete erosion by abrasion, hydrostatic pressure, soil or foundation problems, freeze/thaw cycles, normal aging, submerged water environment, poor concrete quality, reinforcement corrosion, structural overloading, reactive concrete aggregate, unsuccessful concrete repair, and other.

In addition, some space was left at the bottom of the survey questionnaire page to allow the project personnel to respond in more detail if they felt the need. The intent of these final questions was also to find catastrophic incidences that may have occurred at projects and gauge the willingness of personnel at various projects to participate more fully in the research project. These questions were posed as:

- Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?
  - If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.
  - If yes, please give the project name, and a description of the problem including the type of structure with the problem, time frame you have been dealing with problem, probable cause, etc.
- Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

The overall goals for the survey were to obtain as many responses as possible with basic information that could lead to determining common problems, and to find the projects most interested in participating further. The projects with the most need and most interest in participating were then going to be contacted and visited to obtain more information. The blank survey form is shown in appendix A.



## Survey Instructions

A cover letter was developed explaining the purpose of the survey and requesting each person's assistance. The letter that was sent out with the survey via email is shown in below:

This survey is the first component of the Science and Technology Program research project "Evaluation and Innovative Solutions to Reclamation Spillway and Water Conveyance Structure Need." You were targeted to complete the survey because of you provide direct oversight of Reclamation's projects. The objective of this survey is to determine and prioritize problems within Reclamation's spillway, outlet works, and conveyance systems. The survey is not intended to be all-inclusive but a first step in determining the most common problems Reclamation-wide. Gathering of more detailed information may follow after compilation of these results.

The research project is to determine the cause of the most common problems, identify potential solutions, and perform a demonstration of a new cost-saving technology - potentially on one of your projects. The ultimate goal is to assist Reclamation in continuing to provide safe passage of floods and uninterrupted water delivery.

The survey is simply asking what portions of your structures cause the most trouble and what the most common observations are. The survey is an Excel spreadsheet. One survey sheet can be completed based upon your knowledge of all the projects under your jurisdiction or if you want to be more specific you may fill out additional sheets for individual projects. Please feel free to add further comments or description of your various situations.

The team working on this project from the TSC consists of Kathy Frizell, Darrel Krause, Bill Bouley, Elisabeth Cohen, and Steve Robertson. If you have any questions or comments relating to the survey please feel free to contact any of the team members. For spillway and outlet works questions the primary contact is Kathy Frizell at 303-445-2144 or [kfrizell@do.usbr.gov](mailto:kfrizell@do.usbr.gov). For water conveyance system questions the primary contact is Steve Robertson at 303-445-3123 or [srobertson@do.usbr.gov](mailto:srobertson@do.usbr.gov).

Please email your completed survey by October 9th, 2003 to Kathy Frizell or mail your completed hardcopy to:

USBR  
Denver Federal Center  
Kathy Frizell, D-8560  
P.O. Box 25007  
Denver, CO 80225

Thanks in advance for your effort on this project!

The survey was first distributed in September of 2003 and then resent in June of 2004 to encourage more responses. There were 32 inquiries sent out to project personnel whom the team felt were key. Many of the personnel had numerous projects they were responsible for, and it was hoped that they would respond or ask someone else to respond for each of the projects under their responsibility.

The Office of Program and Policy Services mailing list from Darrel Krause was used to send out the survey to specified project personnel.

The list of Personnel receiving the survey questionnaire included Reclamation Regional, Area, and Field Office staff:

James Allard; Karl Ames; Don Bader; James Bowman; Keith Brooks; Jim Bryant; Jerry Cheek; Brad Dodd; Tony Hargroves; Gene Harms; David Johnson; Sean Keeney; Duane Krogstad; Ken Lally; William “Mike” Larson; Drew Lessard; Steve Lux; Frank Macaluso; Jeff Magers; Robert Major; John Moody; Joe Pennino; Gene Price; Jan Schrader; Terry Seitz; Edward Vidmar; Anthony Vigil; Darrin Williams

The following was the list of personnel who were contacted during the resend of the survey in June 2004.

David Johnson, Don Bader, Drew Lessard, Duane Krogstad, Gene Harris, Gene Price, James Allard, James Bowman, Jan Schrader, Jerry Cheek, Joe Pennino, John Moody, Karl Ames, Keith Brooks, Ken Lally, Steve Lux, Terry Seitz, Tony Hargroves, William “Mike” Larson

Survey responses came in slowly and were compiled during the summer of 2004.

## Survey Results

The intent of this request was to get initial feedback from the people on the ground working on the projects. The projects showing the most interest in participating and with the most need were then going to be contacted and visited to provide more information. This portion of the research project was not funded and was not accomplished.

The results shown in the following section are from those Reclamation Regional and Area Offices that replied. There were 14 respondents out of the 32 surveys that were sent out, producing a 44-percent response. Appendix B contains the individual survey sheets of the respondents. Unfortunately, only a few project managers replied with specific needs on specific projects. The GP region sent in a survey sheet for each project under their purveyance separately, but most other respondents combined their projects together with general replies. In other words, a respondent may have had 10 projects under their oversight and only filled out 1 sheet with generic answers about all 10 of their projects.

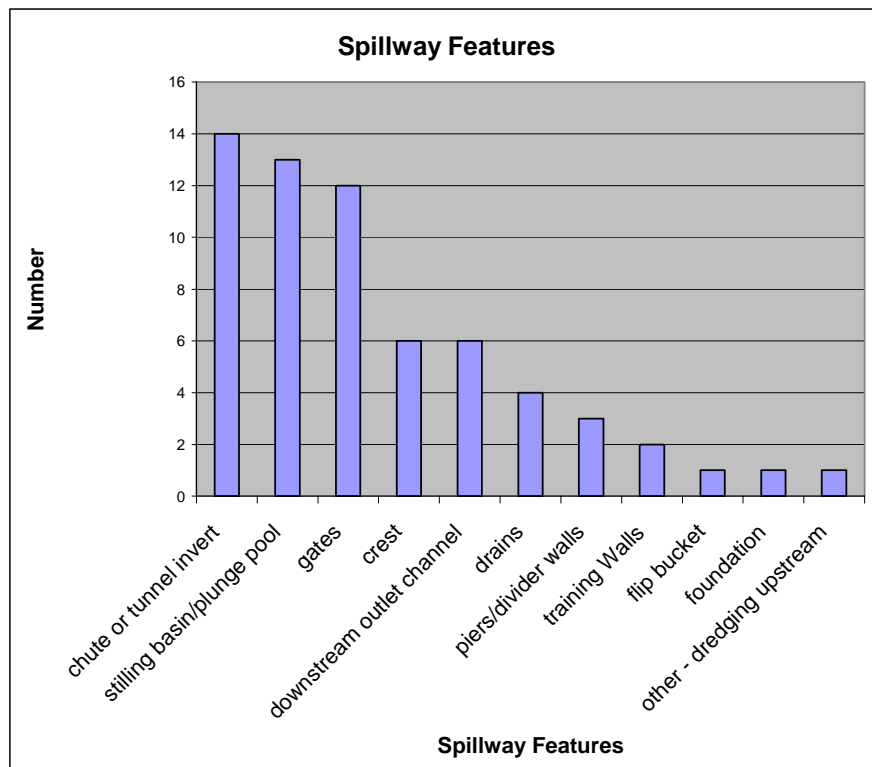
Table 2 shows the summarized results of the survey in a slightly modified form. The questions under each main category were sorted in descending order, ranked with 1 the highest need, and the percentage computed based upon total number of responses in each survey question. These results are as of the summer of 2004.

The responses to additional questions regarding problems at specific projects that have prevented passing of flows or deliveries and additional comments are shown in a following section.

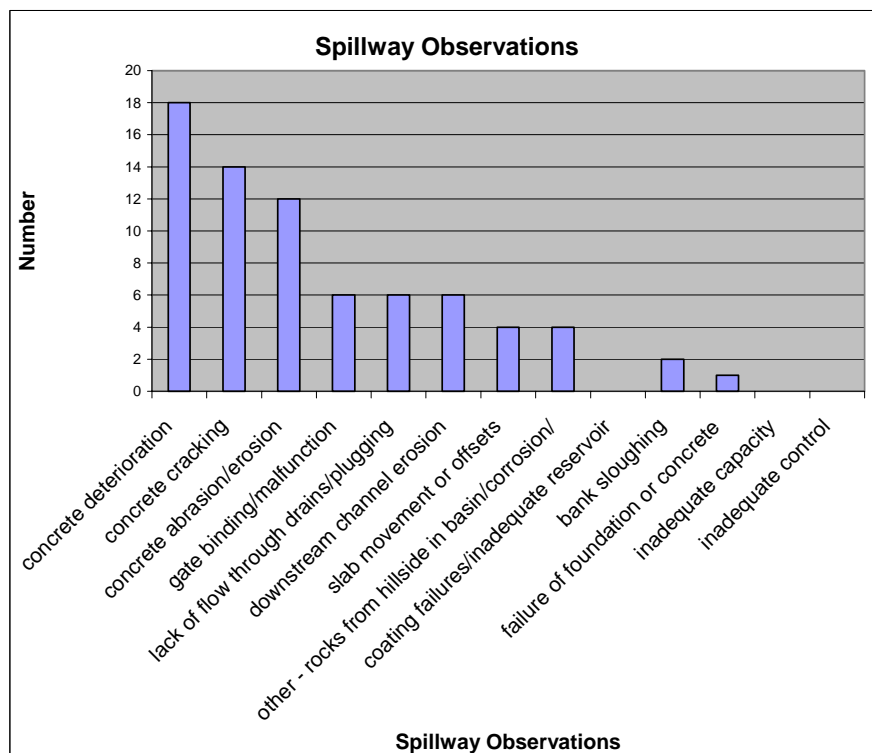
The sorted survey results from table 2 were used to produce the graphical representations for each category on figures 1-3, figures 4-6, and figures 7-9, for the spillway, outlet works, and water conveyance structures, respectively.

**Table 2.**—Sorted summary of survey results showing the rank and percentage of total number of responses in each survey category from the individual survey responses in appendix B

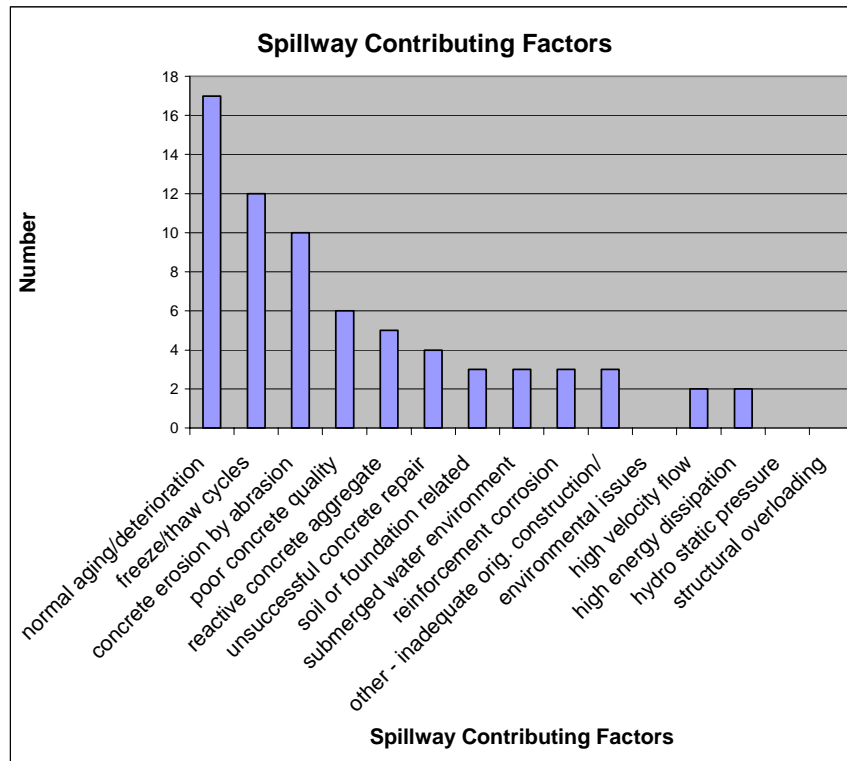
Spillway Structure (either concrete or earthen)								
Given all the projects with spillway features that you oversee, what features cause you the most trouble?			What do you observe that causes the concerns you stated for your spillway structure features?			What do you suspect are major contributing factors that jeopardize your systems ability to function?		
RANK	PERCENT	Check 3 most problematic	RANK	PERCENT	Check all that apply	RANK	PERCENT	Check all that apply
1	22%	14 chute or tunnel invert	1	25%	18 concrete deterioration	1	24%	17 normal aging/deterioration
2	21%	13 stilling basin/plunge pool	2	19%	14 concrete cracking	2	17%	12 freeze/thaw cycles
3	19%	12 gates	3	16%	12 concrete abrasion/erosion	3	14%	10 concrete erosion by abrasion
4	10%	6 crest	4	8%	6 gate binding/malfunction	4	9%	6 poor concrete quality
4	10%	6 downstream outlet channel	4	8%	6 lack of flow through drains/plugging	5	7%	5 reactive concrete aggregate
6	6%	4 drains	4	8%	6 downstream channel erosion	6	6%	4 unsuccessful concrete repair
7	5%	3 piers/divider walls	7	5%	4 slab movement or offsets	7	4%	3 soil or foundation related
8	3%	2 training Walls	7	5%	4 other - rocks from hillside in basin/corrosion/	7	4%	3 submerged water environment
9	2%	1 flip bucket	7	5%	4 coating failures/inadequate reservoir	7	4%	3 reinforcement corrosion
9	2%	1 foundation	9	3%	2 bank sloughing	7	4%	3 other - inadequate orig. construction/
9	2%	1 other - dredging upstream	10	1%	1 failure of foundation or concrete	7	4%	3 environmental issues
		63 TOTAL	11	0%	0 inadequate capacity	11	3%	2 high velocity flow
			11	0%	0 inadequate control	12	3%	2 high energy dissipation
					73 TOTAL	13	0%	0 hydro static pressure
						13	0%	0 structural overloading
								70 TOTAL
Outlet Works Structure								
Given all the projects with outlet works features that you oversee, what features cause you the most trouble?			What do you observe that causes the concerns you stated for your outlet works structure features?			What do you suspect are major contributing factors that jeopardize your systems ability to function?		
RANK	PERCENT	Check 3 most problematic	RANK	PERCENT	Check all that apply	RANK	PERCENT	Check all that apply
1	29%	17 gates or valves	1	24%	13 concrete deterioration	1	18%	13 normal aging/deterioration
2	19%	11 stilling basin/plunge pool	1	24%	13 concrete abrasion/erosion	2	15%	11 concrete erosion by abrasion
3	12%	7 open channel pipe or chute invert	3	15%	8 concrete cracking	2	15%	11 freeze/thaw cycles
3	12%	7 downstream outlet channel	4	11%	6 downstream channel erosion	4	14%	10 high velocity flow
5	7%	4 intake structure	5	7%	4 lack of flow through drains/plugging	4	14%	10 submerged water environment
5	7%	4 drains	5	7%	4 other - sediment build up/coating failure/	6	8%	6 reinforcement corrosion
7	5%	3 pressurized pipe/conduit	7	0%	3 reports of gates aging	7	4%	3 soil or foundation related
7	5%	3 other - sediment/cavitation/air vents	7	6%	3 gate binding/malfunction	8	3%	2 high energy dissipation
9	3%	2 training walls	8	4%	2 bank sloughing	8	3%	2 poor concrete quality
10	0%	0 crest	9	2%	1 slab movement or offsets	8	3%	2 reactive concrete aggregate
10	0%	0 piers/divider walls	10	0%	0 inadequate capacity	11	1%	1 unsuccessful concrete repair
10	0%	0 flip bucket	10	0%	0 inadequate control	12	0%	0 hydro static pressure
10	0%	0 foundation	10	0%	0 failure of foundation or concrete	12	0%	0 structural overloading
		58 TOTAL			54 TOTAL	12	0%	0 other (specify)
								71 TOTAL
Conveyance Structure								
Given all the projects with conveyance features that you oversee, what features cause you the most trouble?			What do you observe that causes the concerns you stated for your conveyance structure features?			What do you suspect are major contributing factors that jeopardize your systems ability to function?		
RANK	PERCENT	Check 3 most problematic	RANK	PERCENT	Check all that apply	RANK	PERCENT	Check all that apply
1	21%	15 canal lining (concrete, earthen, etc)	1	18%	13 concrete cracking	1	25%	16 normal aging/deterioration
2	16%	12 canals	2	17%	12 concrete deterioration	2	19%	12 freeze/thaw cycles
3	14%	10 cross drainage	3	13%	9 lack of flow through drains/plugging	3	14%	9 soil or foundation related
4	12%	9 siphons	4	10%	7 concrete abrasion/erosion	4	11%	7 concrete erosion by abrasion
5	11%	8 tunnels	5	8%	6 slab movement or offsets	4	11%	7 reinforcement corrosion
6	5%	4 diversion or headworks	5	8%	6 seepage	6	5%	3 hydro static pressure
7	4%	3 check structures	7	7%	5 bank sloughing	6	5%	3 other - old tech/drop chutes/inad design
7	4%	3 foundation	8	6%	4 other - urbanization/landslides/telemetry	8	3%	2 submerged water environment
9	3%	2 pipelines	9	4%	3 inadequate capacity	8	3%	2 poor concrete quality
9	3%	2 pumping plant intake	9	4%	3 inadequate control	8	3%	2 reactive concrete aggregate
9	3%	2 drop/ dissipating structures	9	4%	3 failure of foundation or concrete	11	2%	1 high energy dissipation
9	3%	2 other - gages & telemetry	12	1%	1 downstream channel erosion	12	0%	0 high velocity flow
13	1%	1 underdrains	13	0%	0 gate binding/malfunction	12	0%	0 structural overloading
14	0%	0 pumping plant discharge			72 TOTAL	12	0%	0 unsuccessful concrete repair
		73 TOTAL						64 TOTAL



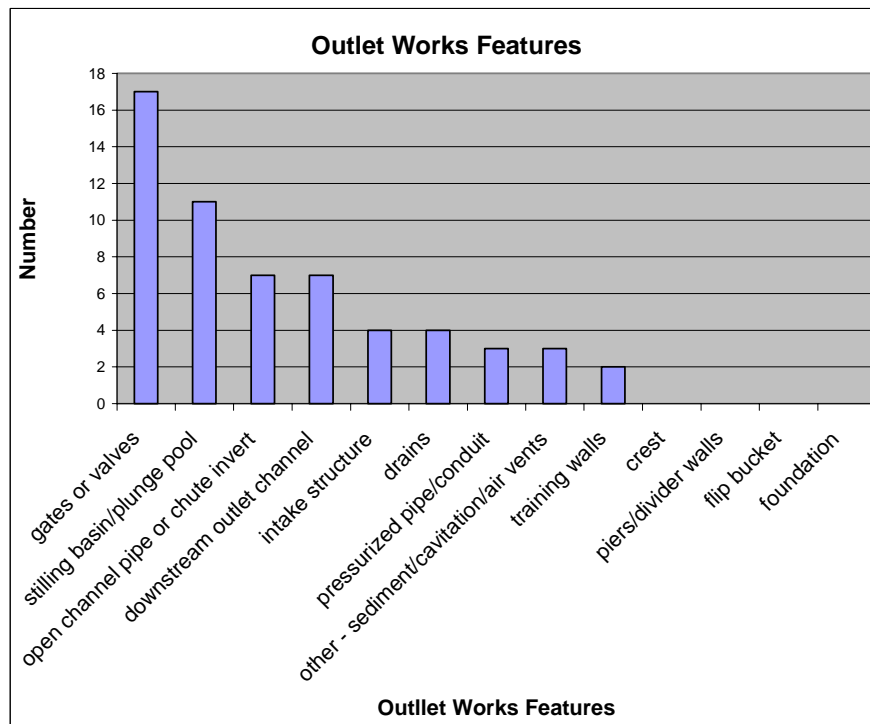
**Figure 1.**—Compiled responses for the most problematic spillway features.



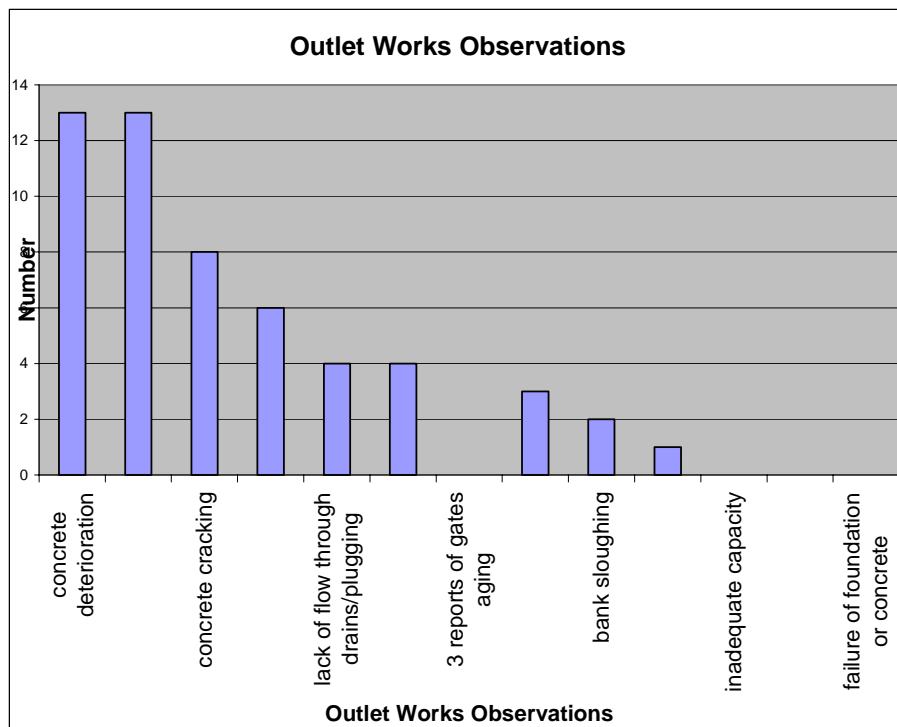
**Figure 2.**—Compiled responses for the most frequent observations made regarding the spillway features.



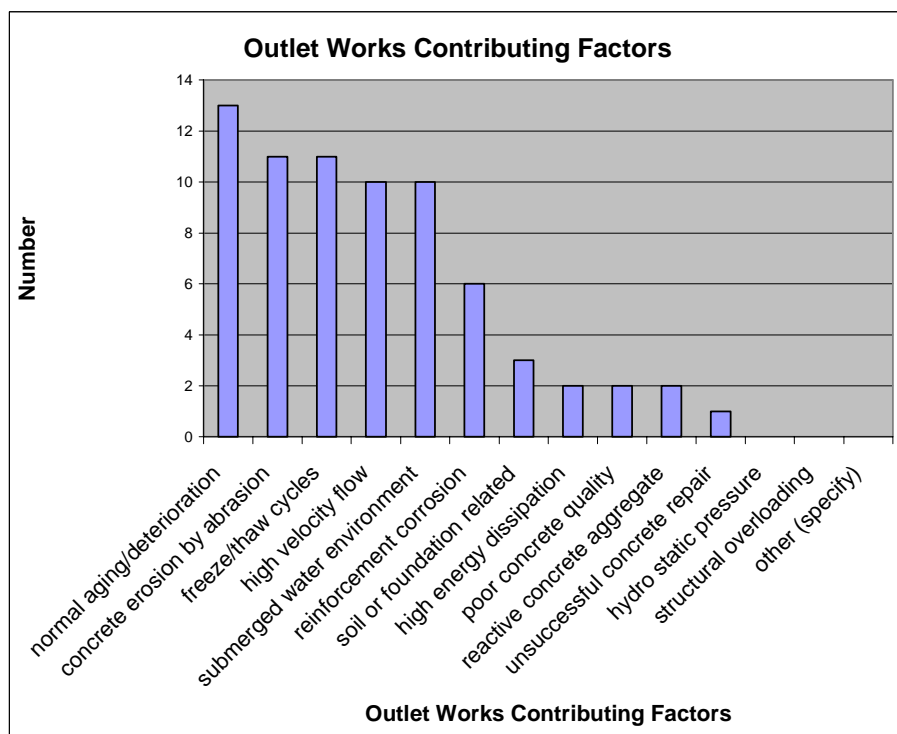
**Figure 3.**—Compiled responses for the perceived reasons or contributing factors causing the observed problems on project spillway features.



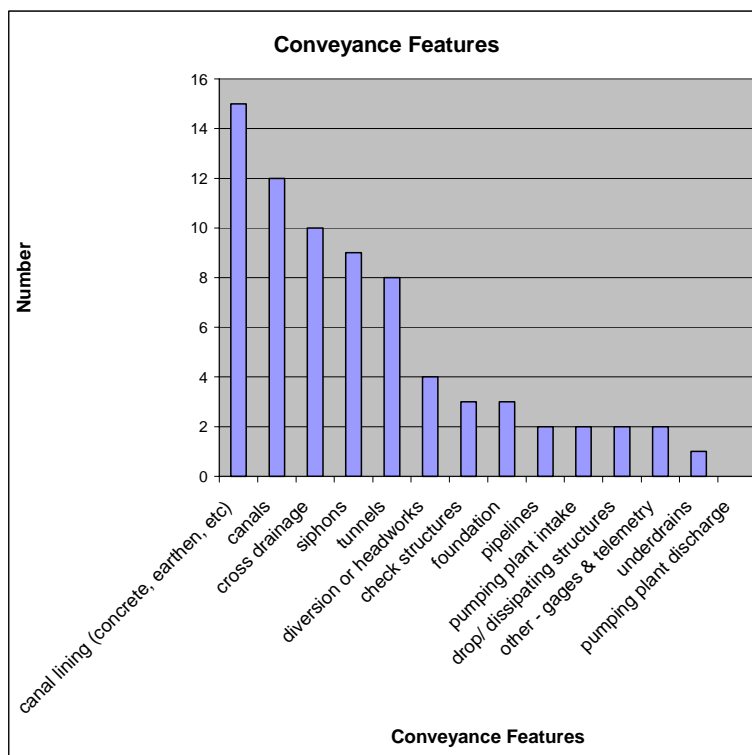
**Figure 4.**—Compiled responses for the most problematic outlet works features.



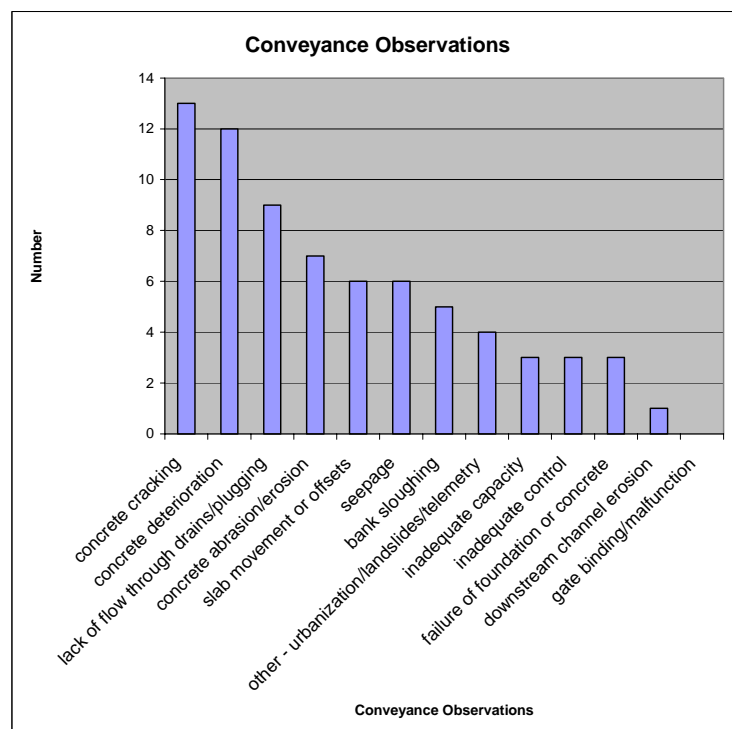
**Figure 5.**—Compiled responses for the most frequent observations made regarding the outlet works features.



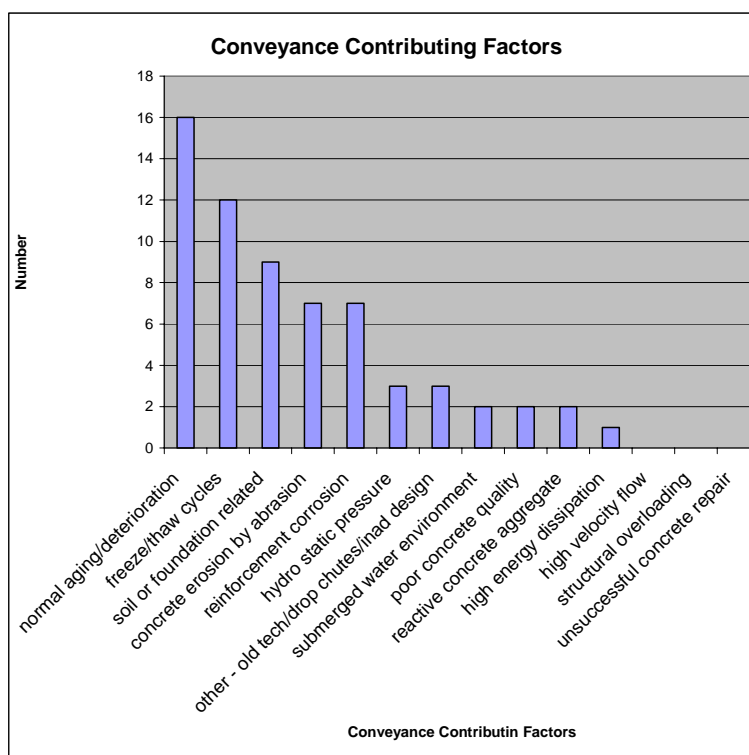
**Figure 6.**—Compiled responses for the perceived reasons or contributing factors causing the observed problems on project outlet works features.



**Figure 7.**—Compiled responses for the most problematic conveyance structure features.



**Figure 8.**—Compiled responses for the most frequent observations made regarding the conveyance structures features.



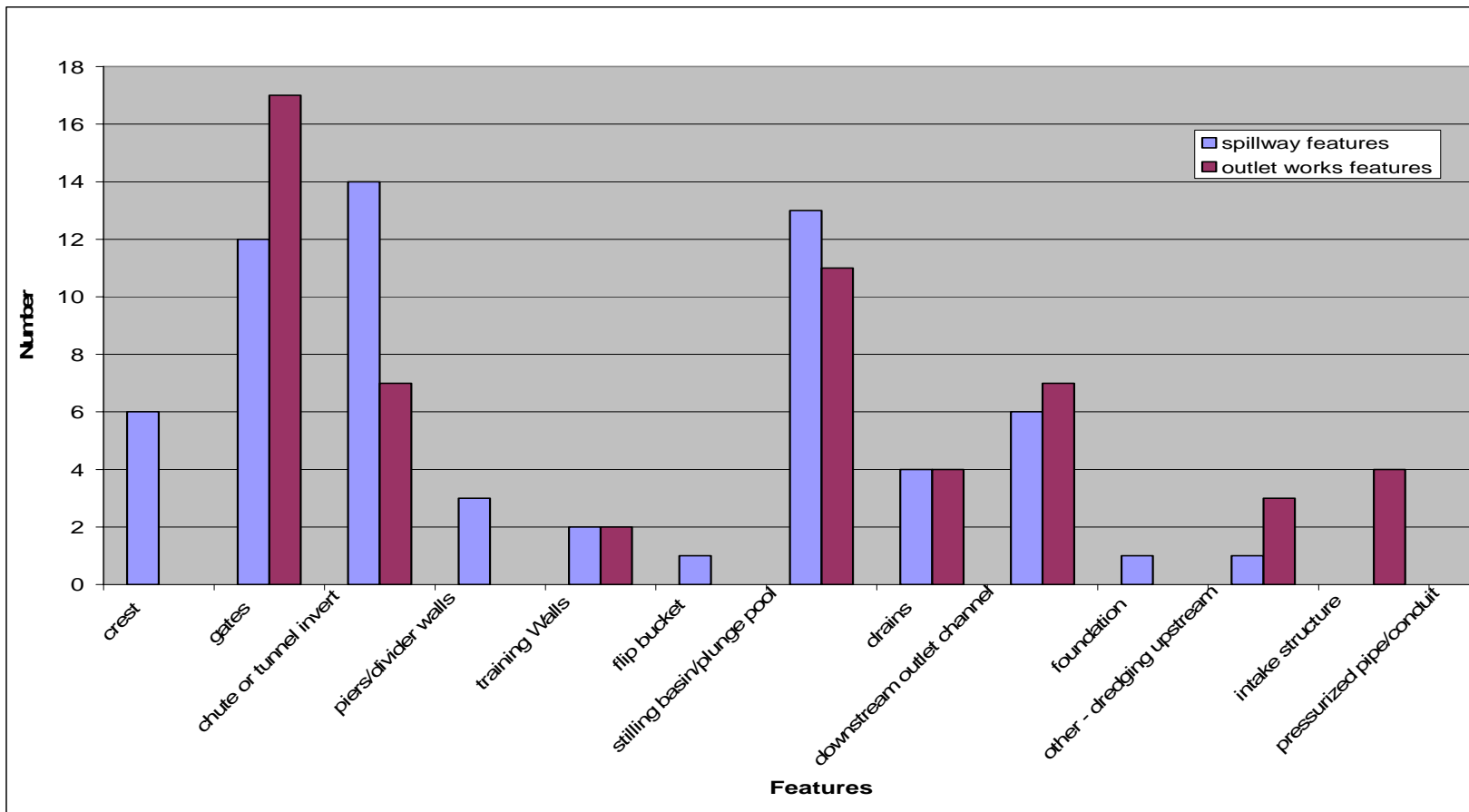
**Figure 9.**—Compiled responses for the perceived reasons or contributing factors causing the observed problems on project conveyance structure features.

The team met to discuss the results of the survey to determine the most common problems identified. The graphs were very helpful in quickly identifying the most problematic issues with the structures, the observations that were causing concerns, and the factors contributing to the problem in the opinion of the field responders. The spillway and outlet works features listed were the same, and the responses were plotted together in figure 10 for comparison.

The conveyance structures feature, of course, had to be different from the spillway and outlet works features, with the conveyance structures having a primarily different function. Therefore, figure 7 was used for comparisons.

Studying figures 10 and 7 and the summary in table 2, it became apparent that for each category of spillway, outlet works, or water conveyance structure, about four issues under each question seemed to be of major interest, with the remainder of the issues significantly less important. Therefore, the following discussion will deal with only the top four issues under each question. The following summary discusses each of the three main categories and three main questions under each category.





**Figure 10.**—Combined responses for the spillway and outlet works features that cause the most trouble.

## Spillway and Outlet Works Structure Feature Needs

**Question: Given all the projects with spillway and outlet works features that you oversee, what features cause you the most trouble?**

The summary of the top four responses to this question for the spillway features causing the most trouble is:

1. Chute or tunnel inverts were identified as in the most need of repair receiving 22 percent of the total number of problems reported.
2. Stilling basin or plunge pool structures received 21 percent of the total responding to problems.
3. Spillway gates were the third most problematic receiving 19 percent of the votes.
4. The crest structures and the downstream channel area tied for fourth in the spillway feature problems, both with 10 percent of the responses.

The summary of the top four responses to this question for the outlet works features causing the most trouble is:

1. Outlet works gates were identified as, by far, the most problematic, receiving 29 percent of the votes.
2. Stilling basin or plunge pool structures received 19 percent of the total responding to problems.
3. Open channel pipe or chute inverts (chute or tunnel inverts) and the downstream outlet channel area were tied for third receiving 12 percent of the total number of problems reported.

The top four features causing problems with their ranking and percentage of respondents replying is shown in table 3. The combined scores show the sum of the percentages across the structures.

Clearly, the most problematic features of spillways and outlet works structures are the gates, condition of the concrete inverts subjected to flow, and the stilling basins or plunge pool energy dissipating structures. Erosion of the downstream outlet channels was the fourth rated problem with most other items in the category only minimally rated a concern.

**Table 3.**—Summary of spillway and outlet works structure feature problems

Problem	Spillway problem		Outlet works problem		Combined scores	
	Rank	Percentage	Rank	Percentage	Rank	Total percentage
Gates	3	19	1	29	1,3	48
Chute or tunnel invert	1	22	3	12	1,3	44
Stilling basin/plunge pool	2	21	2	19	2	40
Downstream outlet channel	4	10	3	12	3,4	22
Crest	4	10	n/a	n/a	4	10

## Conveyance Structure Feature Needs

**Question:** Given all the projects with conveyance features that you oversee, what features cause you the most trouble?

The water conveyance structure problems were somewhat different than those of the spillways and outlet works structures, as expected. Therefore, figure 7, along with table 2 was used to summarize the top four responses to this question for the conveyance structure features causing the most trouble.

1. Canal lining issues were identified as in the most need of repair, receiving 21 percent of the total number of problems reported.
2. Canals generically received 16 percent of the total responding to problems.
3. Cross drainages were the third most problematic, receiving 14 percent of the votes.
4. Siphon structures were fourth, receiving 12 percent of the total number of responses.

These features causing problems in conveyance structures with their ranking and percentage of respondents replying is shown in table 4.

Table 4.—Summary of conveyance feature structure feature problems.

Problem	Conveyance structure problem	
	Rank	Percentage
Canal lining	1	21
Canals	2	16
Cross drainage	3	14
Siphons	4	12

Issues with the canal systems in general and specifically the lining were the main problems reported by the respondents. The observations that describe the problems are discussed in the following section.

## Observations of the Causes for the Concerns Stated about the Structure Features

The items under the questions regarding observations and factors were intentionally the same for all structure categories so that comparisons could be made. The results from table 2 were plotted on figure 11 for all the observations of the structures.

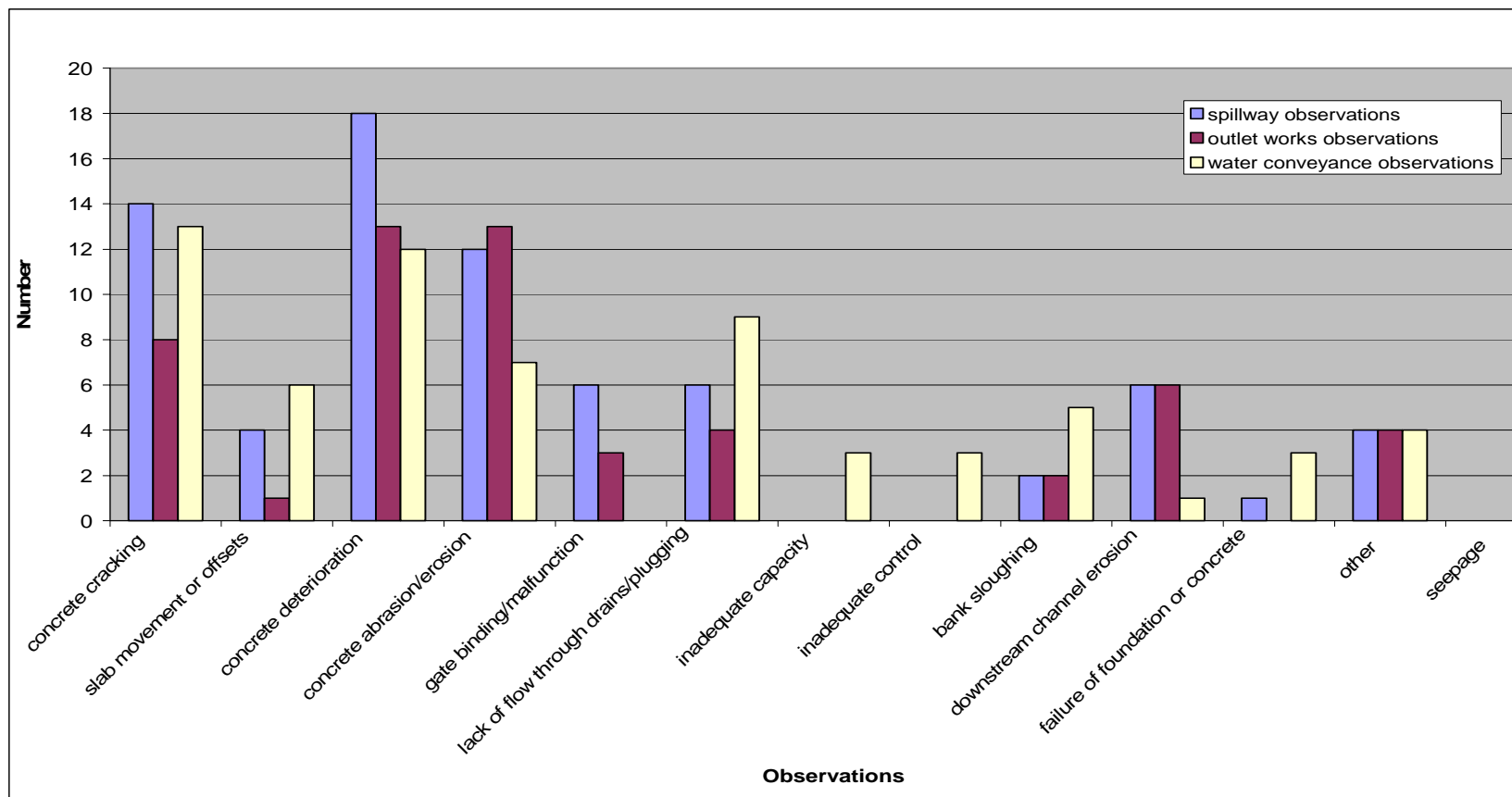
### **Question: What do you observe that causes the concerns you stated for your spillway, outlet works, and conveyance structure features?**

The top four answers to this question for the spillway features were:

1. Concrete cracking (25 percent)
2. Deterioration (19 percent)
3. Abrasion and erosion (16 percent) dealing with chutes, tunnels, and stilling basin concrete
4. Three observations tied with 8 percent of the responses: drainage systems did not seem to be functioning properly, leading to issues with the concrete structures; erosion in the downstream channel area was observed to be an issue; and finally, gate binding and general malfunction.

The top four answers to this question for the outlet works features were:

1. Concrete deterioration and concrete abrasion or erosion were tied for first at 24 percent,



**Figure 11.**—Compiled responses to the question of what observations were made that led to the conclusion that specific spillway, outlet works, and conveyance structure features were problematic.

3. Concrete cracking (15 percent)
4. Downstream channel erosion (11 percent)

The top four answers to this question for the conveyance structure features were

1. Concrete cracking (18 percent)
2. Concrete deterioration (17 percent)
3. Lack of flow through drains or plugging of drains (13 percent)
4. Concrete abrasion or erosion (10 percent)

These observations of the factors causing concerns with all the spillway, outlet works, and conveyance structure features with their ranking and percentage of respondents replying are shown in table 5. The combined scores show the most common observations.

**Table 5.**—Summary of observations for all structures that led respondents to think there was a concern about the features identified with problems

Problem	Spillway observations		Outlet works observations		Conveyance structure observations		Combined scores	
	Rank	%	Rank	%	Rank	%	Rank	Total %
Concrete deterioration	1	25	1	24	2	12	1,1,2	61
Concrete cracking	2	19	3	24	1	13	2,3,1	56
Concrete abrasion or erosion	3	16	1	15	4	7	3,1,4	38
Lack of flow through drains	4	8	n/a*		3	9	4,n/a,3	17
Gate binding	4	8	n/a	n/a	n/a	n/a	4,n/a,n/a	8
Downstream channel erosion	n/a	n/a	4	11	n/a	n/a		n/a,4,n/a

\* Where n/a is located in a cell, the ranking was below fourth for that structure.

The most common observation across the features with problems was concrete deterioration and cracking.

## Major Contributing Factors that Jeopardize Structure Function

The contributing factors items were the same for each structure. The results from table 2 were plotted on figure 12 for all the factors jeopardizing the proper function of all the structures.

### **Question: What do you suspect are major contributing factors that jeopardize your systems ability to function?**

The top four answers to this question for the spillway were

1. Normal aging or deterioration (24 percent),
2. Freeze/thaw cycles (17 percent),
3. Concrete erosion by abrasion (14 percent)
4. Poor quality concrete (9 percent)

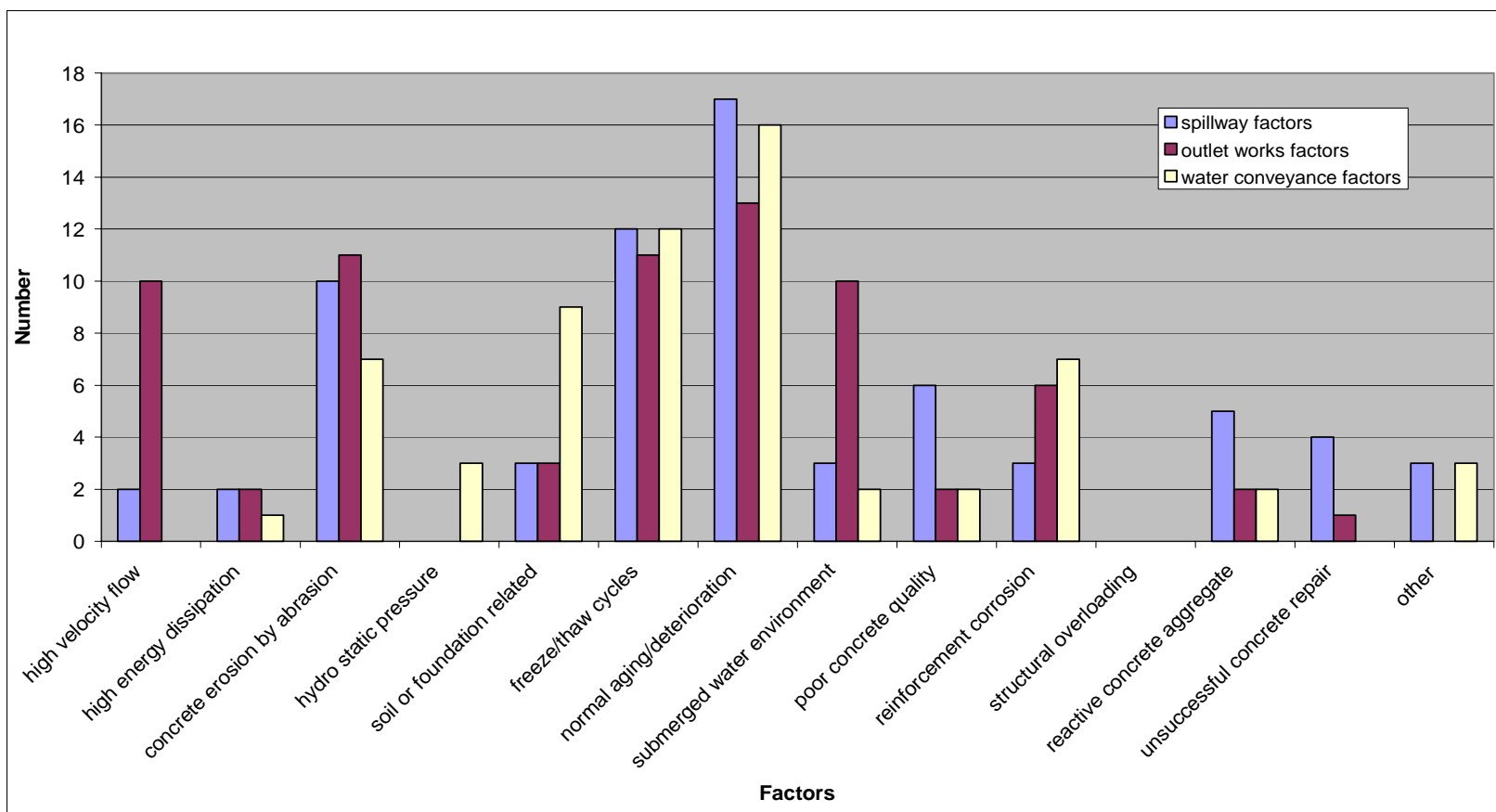
The top four answers to this question for the outlet works were

1. Normal aging or deterioration (18 percent),
2. Concrete erosion by abrasion and freeze/thaw cycles were tied for second with 15 percent,
4. High velocity flow causing the problem and submerged water environment were tied for fourth with 14 percent.

The top four answers to this question for the conveyance structures were

1. Normal aging or deterioration (25 percent),
2. Freeze/thaw cycles (19 percent),
3. Soil or foundation related (14 percent)
4. Concrete erosion by abrasion and reinforcement corrosion were tied for fourth at 11 percent.

These major contributing factors that jeopardize all the spillway, outlet works, and conveyance structure system to function with their ranking and percentage of respondents replying are shown in table 6. The combined scores show the most common factors.



**Figure 12.**—Compiled responses to the question of the major contributing factors that jeopardize functioning of the specific spillway, outlet works, and conveyance structure systems.



**Table 6.**—Compiled responses to the question of the major contributing factors that jeopardize functioning of the specific spillway, outlet works, and conveyance structure systems

Problem	Spillway factors		Outlet works factors		Conveyance structure factors		Combined scores	
	Rank	%	Rank	%	Rank	%	Rank	Total %
Normal aging or deterioration	1	24	1	18	1	25	1,1,1	67
Freeze/thaw cycles	2	12	2	15	2	19	2,2,2	46
Concrete erosion by abrasion	3	10	2	15	4	11	3,2,4	36
Soil or foundation related	n/a*	n/a	n/a	n/a	3	14	n/a,n/a,3	14
Submerged water environment	n/a	n/a	4	14	n/a	n/a	n/a,4,n/a	14
High velocity flow	n/a	n/a	4	14	n/a	n/a	n/a,4,n/a	14
Poor quality concrete	4	9	n/a	n/a	n/a	n/a	4,n/a,n/a	9
Reinforcement corrosion	n/a	n/a	n/a	n/a	4	11	n/a,n/a,4	11

\* Where n/a is located in a cell, the ranking was below fourth for that structure.

Clearly concrete issues still were identified as the major contributing factor that would jeopardize functioning of spillway, outlet works, and conveyance structures.

## Current Research

The following research programs (whether Science and Technology or Dam Safety) are addressing three of the top concerns expressed in the survey:

- The most obvious problem was that of concrete aging due to the age of Reclamation's infrastructure. This problem is already being addressed by an ongoing Science and Technology project called Developing Advanced Construction Materials to Improve, Repair, and Maintain Reclamation Structures, and another project called Bond Quality of Fiber Reinforced Polymer Concrete Strengthening Systems, both led by Kurt VonFay of the Materials Engineering and Research Laboratory Group at the TSC.

- The second ranked significant problem dealt with spillway and outlet works stilling basin abrasion. This problem is also being addressed by an ongoing Science and Technology project called Flow deflectors for Preventing Type II and Type III Stilling Basin Abrasion Damage (Widespread Application), and another project called Stilling Basin Abrasion Damage Prevention (Mason Dam Flow Deflector Design, lead by Leslie Hanna of the Water Resources Research Laboratory Group at the TSC.
- Another problem identified, although not ranked particularly high in this survey, is uplift of concrete slabs without reinforcement across the slab joints in spillways. This problem is being addressed in by a project called Improved Estimation of Uplift and Subsurface Flow in High Velocity Spillway Channels with Cracks and Offsets, which was funded in mid-FY05 by the Dam Safety Research Program. The 2-year project will use a physical sectional model of a crack section along with three-dimensional computational modeling to develop a set of guidelines to assist designers and engineers in evaluating new and old designs.

In addition, Reclamation carried out a workshop supported by the Federal Emergency Management Agency to identify dam safety research needs relating to spillways. The final report from the workshop entitled *Issues, Remedies, and Research Needs Relating to Dam Service and/or Emergency Spillways*, also provides information regarding nationwide spillway research needs [7]. This document may also be found on the web at [www.fema.gov/pdf/fima/damsafe/dam-spillways-part-1.pdf](http://www.fema.gov/pdf/fima/damsafe/dam-spillways-part-1.pdf).

## Continuing Maintenance Problems and Failed Passage of Water

**Question: Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?**

The personnel answering the survey were concerned about 12 projects that reported continued maintenance issues. Seven projects responded that the problems were not continual, implying that they were newly discovered or were not of a magnitude to be concerned with yet.

**Question: If yes, has this continued problem led to the inability of your structure to pass flow or make deliveries?**

Three projects were reported as unable to pass flow or make deliveries due to the poor condition of their structures.

**Question: If yes, please give the project name, and a description of the problem including the type of structure with the problem, time frame you have been dealing with problem, probable cause, etc.**

The three projects responding were:

- Friant Dam with concrete aggregate reaction causing piers to move and prevent opening of gates
- Imperial and Senator Wash Dams with sediment buildup preventing deliveries
- Columbia Basin West Canal through Ephrata with inadequate design and major seepage issues

Of these respondents, Friant Dam has solved their problem by installing rubber gates. Imperial and Senator Wash Dams and the Columbia Basin West Canal are continuing to experience the problems they relayed through their survey response. See the briefing paper provided in appendix B following the survey response for the Columbia Basin West Canal.

## **Possible Demonstration Sites**

**Question: Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?**

There were five positive responses to this question from the survey participants. The projects, problem description, and personnel who indicated interest in participating in demonstration of a potentially innovative solution were:

- Taylor Park Dam—spillway concrete crest repair, Upper Colorado Region, Glenn Stone, Western Colorado Area Office
- Scofield Dam—concrete repair, Upper Colorado Region, Dan Grundvig, Provo Area Office
- Hyrum Dam spillway slab foundation voids with no slab reinforcement or any site—Pacific Northwest Region, Keith Brooks, Burley, Idaho
- Imperial and Senator Wash Dams—sediment issues, Lower Colorado Region, Frank Macalusco, Yuma Area Office
- Columbia Basin West Canal—concrete lining seepage and capacity issues, Pacific Northwest Region, John Moody, Ephrata Field Office

Some of these sites have since begun traditional repairs, which are summarized in the next section. The remainder of the projects would probably still be interested in assistance should an innovative solution be determined and funding obtained.

## Repair Methods and Costs

The projects listed here are those for which project managers had responded extremely favorably to the survey. They were very interested in participating in a demonstration project or wanted to be proactive in the repair of their structures. After revisiting the projects, the team found that the following three projects already had conventional repairs underway. The repair method and projected costs associated with the repair for these projects are discussed here.

### Taylor Park Dam



**Figure 13.**—Taylor Park Dam, Colorado.

Taylor Park Dam is a zoned earthfill structure 206 feet high, constructed between 1935 and 1937, and located in western Colorado. The dam is founded on highly jointed bedrock, alluvial deposits, and some talus cone material. The spillway is an uncontrolled side-channel overflow-type weir crest 180 feet long with a capacity of 10,000 ft<sup>3</sup>/s. The spillway is not operated frequently, primarily due to the Myosis Shrimp population, but also because of heavily damaged areas on the spillway crest and chute.

A service agreement was undertaken between the Western Colorado Area Office and Kurt VonFay of the TSC to identify the problem and recommend a repair

scenario. The cause of the damage was determined to be freeze-thaw action on nonair-entrained concrete surfaces, and the repair was specified to be of a like kind of concrete. The Uncompahgre Water Association will be making repairs each year on 20-foot long slab sections of the spillway crest and chute for the next 6 or 7 years. The cost each year of the repair will be about \$15,000.

## Scofield Dam



**Figure 14.**—Scofield Dam, Utah.

Scofield Dam is zoned earthfill structure with a structural height of 125 feet located in central Utah, and was constructed between 1943 and 1946. The concern is that high velocities in the spillway chutes are high enough to cause hydraulic jacking, which would lift the spillway slabs and expose a highly erodible foundation. The spillway has no keys, no reinforcement across joints, no waterstops, and there are unfiltered open joints in the drain system. The entire spillway slab will be replaced at a cost of approximately \$7,000,000 in the near future.

## Hyrum Dam

Hyrum Dam is a rolled earth-filled structure, with a structural height of 116 feet, located in northern Utah and constructed between 1934 and 1935. The spillway is founded on fine-grained highly erodible Bonneville Lake deposits. The recent modifications involved replacement of the invert slab of the steep section of the spillway. The issue involved erosion of the spillway foundation. Initially the problem surfaced as holes along the sides of the spillway chute. These holes were initially thought to be due to animal activities and only later determined to be piping and erosion of the foundation. Cracks in the spillway chute were

discovered during an inspection. The chute was investigated using ground penetrating radar. Voids discovered in this manner were then investigated by drilling through the concrete slab and using video inspection. Voids up to 3 feet deep were discovered using the video inspection. The slab at Hyrum was underreinforced, with no reinforcement across the joints and no waterstops. There was also no filter around the two drains. The spillway was designed for 5,600 ft<sup>3</sup>/s but investigations determined that erosion occurred at flows as small as 50 ft<sup>3</sup>/s. The cost of the work was \$680,421, and the work was completed in November 2004.



**Figure 15.**—Hyrum Dam, Utah.

## **Columbia Basin West Canal**

The Main Canal conveys up to 9,600 ft<sup>3</sup>/s to the bifurcation, and the West Canal conveys up to 4,800 ft<sup>3</sup>/s to the W20 check. It is one of two canals formed by the bifurcation of the Main Canal. The West Canal conveys water to over 250,000 irrigated acres and a length of 82.2 miles. The West Canal skirts the northwest periphery of the project and en route is carried across the lower Grand Coulee through the world's largest inverted siphon at the north end of Soap Lake. The canal continues around the upper margin of Quincy Basin to the northern base of Frenchman Hills, which it penetrates by a 9,000-foot tunnel, ending in an easterly branch across the Royal Slope. The capacity of the canal is reduced progressively as water is diverted into lateral distribution systems built to serve the entire northwestern portion of the project.

The Quincy-Columbia Basin Irrigation District (QCBID) continues to budget for and perform maintenance on the West Canal each year. They focus on reaches with seepage where they replace broken panels, seal cracks, and grout behind the

lining where voids are suspected. Their efforts are very rigorous. They use urea to seal the cracks, which is expensive but very durable. In the past 10 years, QCBID has spent over \$2 million on the West Canal reach between the Soap Lake Siphon and Winchester. Additionally, they do similar maintenance elsewhere in the District and pay their share of the cost of panel replacement on the Main Canal.

The Ephrata Field Office put together an Activity Plan for studying the reach of the West Canal where high groundwater is an issue in the Oasis Park area immediately south of Ephrata. Congress appropriated some money in 2005 that has been used to initiate a study in a cost-share with the QCBID.

## Conclusions

There are clearly some common problems throughout Reclamation's aging infrastructure that are in need of attention. The survey respondents are clearly interested in solving these problems to ensure performance of the structures under their responsibility. In that respect, this survey has been of value. The broad-based attempt to identify problems and solutions, however, was a little too overwhelming for the small team to effectively tackle.

Research programs are addressing the major issues related to concrete condition and repair, stilling basin abrasion, and identifying issues with nonreinforced slabs on spillways.

The top structural problems with spillway and outlet works structures identified that research studies are not addressing were:

- Deterioration of gates and surfaces surrounding gates probably caused by high-velocity flow and cavitation and operation of gates by wire ropes/chains
- Erosion in the channels downstream from the energy dissipation structures or the release points of the structures.
  - This may include enlargement of plunge pools formed by releases.

The top structural problems with conveyance structures identified that research studies are not addressing were:

- Canals issues were more important than pipeline issues.
- Canal linings
- Cross drainages

- Siphons

The top observations and factors causing the structural problems not currently being addressed were identified as:

- Foundation issues causing movement of concrete linings and/or failure in spillways and conveyance canals
  - Drains blocked or not functioning
  - Seepage and groundwater problems
  - Submerged structures
- Gate binding
- High velocity flow causing many issues

## Future Tactic

Future attempts to address Reclamation's aging infrastructure should separate the conveyance structures, such as canals, pipelines, and siphons, from the spillways and outlet works issues. Any of the issues identified in the survey could be followed up upon with future **specific** research projects.

The consensus of the team was that this project was a worthwhile effort; however, the ability to address all the issues was limited. Coordination of an effort like this definitely needs a centralized Reclamation point of contact. Broad-based support has successfully been developed for certain aspects of structure rehabilitation and/or repairs, namely concrete repair, stilling basin deflectors, and just recently investigation of spillway slab uplift pressures, but many of these efforts have taken years of planning and major failures to obtain a meaningful commitment.

This project could be continued in the future by tracking issues with an active database and point of contact within the Technical Service Center (TSC) that have support, funding, and management cooperation.

Being able to effectively query a database, or potentially adding this capability to the Dam Safety Information System (DSIS) database, would be extremely beneficial for future similar endeavors.



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# **Appendix A**

## **Blank screening survey**

# **RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003**

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: \_\_\_\_\_

Office: \_\_\_\_\_

Report on Project or projects: \_\_\_\_\_

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

<b>Spillway Structure</b> (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>  Check 3 most problematic <input type="checkbox"/> crest <input type="checkbox"/> gates <input type="checkbox"/> chute or tunnel invert <input type="checkbox"/> piers/divider walls <input type="checkbox"/> training Walls <input type="checkbox"/> flip bucket <input type="checkbox"/> stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify) _____	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>  Check all that apply <input type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> concrete deterioration <input type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify) _____	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>  Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify) _____
<hr/>		
<b>Outlet Works Structure</b>		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>  Check 3 most problematic <input type="checkbox"/> intake structure <input type="checkbox"/> pressurized pipe/conduit <input type="checkbox"/> crest <input type="checkbox"/> gates or valves <input type="checkbox"/> piers/divider walls <input type="checkbox"/> open channel pipe or chute invert <input type="checkbox"/> training walls <input type="checkbox"/> flip bucket <input type="checkbox"/> stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify) _____	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>  Check all that apply <input type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> concrete deterioration <input type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify) _____	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>  Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify) _____
<hr/>		
<b>Conveyance Structure</b>		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>  Check 3 most problematic <input type="checkbox"/> diversion or headworks <input type="checkbox"/> canals <input type="checkbox"/> canal lining (concrete, earthen, etc) <input type="checkbox"/> pipelines <input type="checkbox"/> pumping plant intake <input type="checkbox"/> pumping plant discharge <input type="checkbox"/> tunnels <input type="checkbox"/> siphons <input type="checkbox"/> underdrains <input type="checkbox"/> cross drainage <input type="checkbox"/> check structures <input type="checkbox"/> drop/ dissipating structures <input type="checkbox"/> foundation <input type="checkbox"/> other (specify) _____	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>  Check all that apply <input type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> concrete deterioration <input type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> seepage <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify) _____	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>  Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify) _____

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects? Yes No

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries. ☐ ☐

If yes, please give the project name, and a description of the problem including the type of structure with the problem, time frame you have been dealing with problem, probable cause, etc. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign? Yes No

Comments: (over or use 2nd page) \_\_\_\_\_  
 \_\_\_\_\_

## **Appendix B**

The appendix includes the original responses to the survey received from the projects. They are organized by region as follows: GP, LC, MP, PN, and UC.

**RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003**

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Duane KrogstadOffice: Dakotas Area Office

Report on Project or projects:

Dickinson Dam, Heart Butte Dam, Jamestown Dam, Fort Clark ID, WHRID

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

<b>Spillway Structure</b> (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> crest	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> 1 gates	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> chute or tunnel invert	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> 1 normal aging/deterioration
<input checked="" type="checkbox"/> 1 drains	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> 1 submerged water environment
<input checked="" type="checkbox"/> 1 downstream outlet channel	<input checked="" type="checkbox"/> 1 bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
	Access for viewing and inspecting	<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Outlet Works Structure</b>		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> intake structure	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> gates or valves	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> open channel pipe or chute invert	<input checked="" type="checkbox"/> 1 lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> 1 normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> 1 submerged water environment
<input type="checkbox"/> stilling basin/plunge pool	<input checked="" type="checkbox"/> 1 bank sloughing	<input type="checkbox"/> poor concrete quality
<input checked="" type="checkbox"/> 1 drains	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input checked="" type="checkbox"/> 1 downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> other (specify)	Access for viewing and inspecting	<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Conveyance Structure</b>		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> diversion or headworks	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> canals	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> 1 canal lining (concrete, earthen, etc)	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> pipelines	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input checked="" type="checkbox"/> 1 pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input checked="" type="checkbox"/> 1 soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> tunnels	<input checked="" type="checkbox"/> 1 inadequate capacity	<input checked="" type="checkbox"/> 1 normal aging/deterioration
<input type="checkbox"/> siphons	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> 1 submerged water environment
<input type="checkbox"/> underdrains	<input checked="" type="checkbox"/> 1 bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes No

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

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	1

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes No  

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Comments: (over or use 2nd page)

**RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003**

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Sean KeeneyOffice: Monatan Area Office

Report on Project or projects: \_\_\_\_\_

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

<b>Spillway Structure</b> (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> crest	<input type="checkbox"/> concrete cracking	<input checked="" type="checkbox"/> 1 high velocity flow
<input type="checkbox"/> gates	<input type="checkbox"/> slab movement or offsets	<input checked="" type="checkbox"/> 1 high energy dissipation
<input checked="" type="checkbox"/> 1 chute or tunnel invert	<input checked="" type="checkbox"/> 1 concrete deterioration	<input checked="" type="checkbox"/> 1 concrete erosion by abrasion
<input type="checkbox"/> piers/divider walls	<input checked="" type="checkbox"/> 1 concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input checked="" type="checkbox"/> 1 flip bucket	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> 1 stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> 1 normal aging/deterioration
<input type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input checked="" type="checkbox"/> 1 failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Outlet Works Structure</b>		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> intake structure	<input type="checkbox"/> concrete cracking	<input checked="" type="checkbox"/> 1 high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> 1 concrete deterioration	<input checked="" type="checkbox"/> 1 concrete erosion by abrasion
<input checked="" type="checkbox"/> 1 gates or valves	<input checked="" type="checkbox"/> 1 concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input checked="" type="checkbox"/> 1 gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> 1 freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> 1 normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> 1 submerged water environment
<input checked="" type="checkbox"/> 1 stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
<input checked="" type="checkbox"/> 1 other ( Air Vents)		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Conveyance Structure</b>		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input checked="" type="checkbox"/> 1 diversion or headworks	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> 1 canals	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> canal lining (concrete, earthen, etc)	<input checked="" type="checkbox"/> 1 concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> pipelines	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input checked="" type="checkbox"/> 1 soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> tunnels	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> 1 normal aging/deterioration
<input type="checkbox"/> siphons	<input checked="" type="checkbox"/> 1 inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input checked="" type="checkbox"/> 1 bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input checked="" type="checkbox"/> 1 drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc. \_\_\_\_\_


Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page) \_\_\_\_\_


## RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Al Graves

Office: LC Region

Report on Project or projects:

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure		
(either concrete or earthen)		
<p><b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> crest</p> <p><input checked="" type="checkbox"/> gates</p> <p><input type="checkbox"/> chute or tunnel invert</p> <p><input type="checkbox"/> piers/divider walls</p> <p><input type="checkbox"/> training Walls</p> <p><input type="checkbox"/> flip bucket</p> <p><input checked="" type="checkbox"/> stilling basin/plunge pool</p> <p><input type="checkbox"/> drains</p> <p><input type="checkbox"/> downstream outlet channel</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you observe that causes the concerns you stated for your spillway structure features?</b></p> <p>Check all that apply</p> <p><input checked="" type="checkbox"/> concrete cracking</p> <p><input type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input type="checkbox"/> concrete abrasion/erosion</p> <p><input checked="" type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input type="checkbox"/> soil or foundation related</p> <p><input type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input checked="" type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input checked="" type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>
<p><b>Outlet Works Structure</b></p> <p><b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input checked="" type="checkbox"/> intake structure</p> <p><input checked="" type="checkbox"/> pressurized pipe/conduit</p> <p><input type="checkbox"/> crest</p> <p><input checked="" type="checkbox"/> gates or valves</p> <p><input type="checkbox"/> piers/divider walls</p> <p><input type="checkbox"/> open channel pipe or chute invert</p> <p><input type="checkbox"/> training walls</p> <p><input type="checkbox"/> flip bucket</p> <p><input type="checkbox"/> stilling basin/plunge pool</p> <p><input type="checkbox"/> drains</p> <p><input type="checkbox"/> downstream outlet channel</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>		
<p><b>What do you observe that causes the concerns you stated for your outlet works structure features?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> concrete cracking</p> <p><input type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input type="checkbox"/> soil or foundation related</p> <p><input type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input checked="" type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input checked="" type="checkbox"/> reactive concrete aggregate</p> <p><input checked="" type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>	
<p><b>Conveyance Structure</b></p> <p><b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> diversion or headworks</p> <p><input type="checkbox"/> canals</p> <p><input checked="" type="checkbox"/> canal lining (concrete, earthen, etc)</p> <p><input type="checkbox"/> pipelines</p> <p><input type="checkbox"/> pumping plant intake</p> <p><input type="checkbox"/> pumping plant discharge</p> <p><input type="checkbox"/> tunnels</p> <p><input type="checkbox"/> siphons</p> <p><input type="checkbox"/> underdrains</p> <p><input checked="" type="checkbox"/> cross drainage</p> <p><input checked="" type="checkbox"/> check structures</p> <p><input checked="" type="checkbox"/> drop/ dissipating structures</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>		
<p><b>What do you observe that causes the concerns you stated for your conveyance structure features?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> concrete cracking</p> <p><input type="checkbox"/> slab movement or offsets</p> <p><input type="checkbox"/> concrete deterioration</p> <p><input type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input checked="" type="checkbox"/> bank sloughing</p> <p><input checked="" type="checkbox"/> seepage</p> <p><input checked="" type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input checked="" type="checkbox"/> soil or foundation related</p> <p><input type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>	

**Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?**

**If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.**

**If yes, please give the project name, and a description of the problem including the type of structure with the problem,**

**time frame you have been dealing with problem, probable cause, etc.**

**Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?**

**Comments: (over or use 2nd page)**



# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Frank Macaluso

Office: Yuma Area Office - River Scheduling Team Leader

Report on Project or projects:

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> gates	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> chute or tunnel invert	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> piers/divider walls	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input checked="" type="checkbox"/> gate binding/malfunction	<input checked="" type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> bank sloughing	<input checked="" type="checkbox"/> poor concrete quality
<input checked="" type="checkbox"/> foundation	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input checked="" type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
need dredging upstream	<input checked="" type="checkbox"/> other (specify) inadequate reservoir	<input type="checkbox"/> reactive concrete aggregate
		<input type="checkbox"/> unsuccessful concrete repair
		<input checked="" type="checkbox"/> other (specify) environmental issues

Outlet Works Structure		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> intake structure	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> gates or valves	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input checked="" type="checkbox"/> other downstream sediment buildup	<input type="checkbox"/> reactive concrete aggregate
<input checked="" type="checkbox"/> other/sediment clearing downstream	<input type="checkbox"/> corrosion / erosion of old gates	<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)

Conveyance Structure		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> diversion or headworks	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> canals	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> canal lining (concrete, earthen, etc)	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> pipelines	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> tunnels	<input type="checkbox"/> inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> siphons	<input checked="" type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input checked="" type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input checked="" type="checkbox"/> other gates and telemetry	telemetry / SCADA failure & errors	<input checked="" type="checkbox"/> other old technology

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc. Imperial Dam, problems since drought and California 4.4 Plan. :

Imperial Dam Reservoir is heavily silted, the reduced reservoir capacity requires reliance on Senator Wash Dam and regulating reservoir.

Senator Wash Dam has its own seeping foundation problems, once again limiting reservoir capacity and hampering ability to make deliveries.

Environmental permitting required for river maintenance above and below the dam is cumbersome, it takes to long, and it is too restrictive.

Tell the environmentalists and the Corps of Engineers to take a hike. We have work to do. (only joking!)

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page)

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Darrin Williams, SCC-434

Office: South-Central California Area Office - Fresno, CA

Report on Project or projects: CVP - Friant Dam

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

<b>Spillway Structure</b> (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> gates	<input checked="" type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> chute or tunnel invert	<input checked="" type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> piers/divider walls	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input checked="" type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify)	<input checked="" type="checkbox"/> reactive concrete aggregate
		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Outlet Works Structure</b>		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> intake structure	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input checked="" type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> gates or valves	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input checked="" type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input checked="" type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> other (specify)		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Conveyance Structure</b>		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> diversion or headworks	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> canals	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> canal lining (concrete, earthen, etc)	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> pipelines	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> tunnels	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> siphons	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

AAR caused 18' x 100' spillway drum gate to bind and fail to operate. Gates were replaced in 1997-1998 with Obermeyer Crest

Gates to allow continued movement in concrete. Movement from the AAR appears to be slowing.

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

Comments: (over or use 2nd page)

**RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003**

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Darrin Williams, SCC-434Office: South-Central California Area Office - Fresno, CAReport on Project or projects: Cachuma Project - Bradbury Dam

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

<b>Spillway Structure</b> (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> crest	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> 1 gates	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> 1 chute or tunnel invert	<input checked="" type="checkbox"/> 1 concrete deterioration	<input checked="" type="checkbox"/> 1 concrete erosion by abrasion
<input type="checkbox"/> piers/divider walls	<input checked="" type="checkbox"/> 1 concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input checked="" type="checkbox"/> 1 gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> 1 stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> 1 normal aging/deterioration
<input type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> 1 submerged water environment
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Outlet Works Structure</b>		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input checked="" type="checkbox"/> 1 intake structure	<input type="checkbox"/> concrete cracking	<input checked="" type="checkbox"/> 1 high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> 1 concrete deterioration	<input checked="" type="checkbox"/> 1 concrete erosion by abrasion
<input checked="" type="checkbox"/> 1 gates or valves	<input checked="" type="checkbox"/> 1 concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> 1 training walls	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> 1 normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input checked="" type="checkbox"/> 1 stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> other (specify)		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Conveyance Structure</b>		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> diversion or headworks	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> canals	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> canal lining (concrete, earthen, etc)	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> 1 pipelines	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> tunnels	<input checked="" type="checkbox"/> 1 inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> siphons	<input checked="" type="checkbox"/> 1 inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input checked="" type="checkbox"/> 1 other (specify) inadequate design

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/> 1
<input type="checkbox"/>	<input checked="" type="checkbox"/> 1

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc. \_\_\_\_\_

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/> 1

Comments: (over or use 2nd page) \_\_\_\_\_

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY

Check or highlight your answers so that the form may be submitted electronically returned by June 24, 2004.

Name: Keith Brooks

Office: SRAO-E Burley, ID.

Report on Project or projects:

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)			
<p><b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input checked="" type="checkbox"/> crest</p> <p><input checked="" type="checkbox"/> gates</p> <p><input checked="" type="checkbox"/> chute or tunnel invert</p> <p><input type="checkbox"/> piers/divider walls</p> <p><input type="checkbox"/> training Walls</p> <p><input type="checkbox"/> flip bucket</p> <p><input type="checkbox"/> stilling basin/plunge pool</p> <p><input type="checkbox"/> drains</p> <p><input type="checkbox"/> downstream outlet channel</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you observe that causes the concerns you stated for your spillway structure features?</b></p> <p>Check all that apply</p> <p><input checked="" type="checkbox"/> concrete cracking</p> <p><input type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input checked="" type="checkbox"/> other (specify)</p> <p>corrosion, coating failure</p>	<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input type="checkbox"/> soil or foundation related</p> <p><input checked="" type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input checked="" type="checkbox"/> other (specify)</p> <p>inadequate original construction</p>	
<p><b>Outlet Works Structure</b></p>			
<p><b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> intake structure</p> <p><input type="checkbox"/> pressurized pipe/conduit</p> <p><input type="checkbox"/> crest</p> <p><input checked="" type="checkbox"/> gates or valves</p> <p><input type="checkbox"/> piers/divider walls</p> <p><input type="checkbox"/> open channel pipe or chute invert</p> <p><input checked="" type="checkbox"/> training walls</p> <p><input type="checkbox"/> flip bucket</p> <p><input checked="" type="checkbox"/> stilling basin/plunge pool</p> <p><input type="checkbox"/> drains</p> <p><input type="checkbox"/> downstream outlet channel</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you observe that causes the concerns you stated for your outlet works structure features?</b></p> <p>Check all that apply</p> <p><input checked="" type="checkbox"/> concrete cracking</p> <p><input type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input checked="" type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input checked="" type="checkbox"/> other (specify)</p> <p>coating failure</p>	<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input checked="" type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input type="checkbox"/> soil or foundation related</p> <p><input checked="" type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>	
<p><b>Conveyance Structure</b></p>			
<p><b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input checked="" type="checkbox"/> diversion or headworks</p> <p><input type="checkbox"/> canals</p> <p><input type="checkbox"/> canal lining (concrete, earthen, etc)</p> <p><input type="checkbox"/> pipelines</p> <p><input type="checkbox"/> pumping plant intake</p> <p><input type="checkbox"/> pumping plant discharge</p> <p><input type="checkbox"/> tunnels</p> <p><input type="checkbox"/> siphons</p> <p><input type="checkbox"/> underdrains</p> <p><input type="checkbox"/> cross drainage</p> <p><input type="checkbox"/> check structures</p> <p><input type="checkbox"/> drop/ dissipating structures</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you observe that causes the concerns you stated for your conveyance structure features?</b></p> <p>Check all that apply</p> <p><input checked="" type="checkbox"/> concrete cracking</p> <p><input type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> seepage</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input type="checkbox"/> soil or foundation related</p> <p><input checked="" type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>	
<p><b>Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?</b></p> <p>If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.</p> <p>If yes, please give the project name, and a description of the problem including the type of structure with the problem, time frame you have been dealing with problem, probable cause, etc.</p>			<p>Yes No</p> <p><input checked="" type="checkbox"/> <input type="checkbox"/></p> <p><input type="checkbox"/> <input checked="" type="checkbox"/></p>
<p><b>Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?</b></p> <p>Comments: (over or use 2nd page)</p>			<p>Yes No</p> <p><input type="checkbox"/> <input checked="" type="checkbox"/></p>

- Jackson Lake Dam spillway ogee is deteriorating due to age and construction practices. The ogee section is drummy and the ones that have been replaced show deteriorated concrete and large timbers embedded in the ogee. We have removed concrete to a depth of 30" and the concrete below this point is drummy but it was decided not to excavate deeper than that.
- Jackson Lake Dam outlet tunnels are deteriorating due to age and construction practices. To date we have found timbers and rock pockets throughout the tunnels.
- Palisades Dam outlet stilling basin has suffered severe erosion and cavitation damage on the floors, dentates and splitter walls. We are spending over \$40,000 each on repairs.
- Minidoka Dam spillway is deteriorating due to age and construction practices. The spillway is suffering extreme freeze thaw damage. The spillway was constructed in such a manner as to allow repairs of a large portion by hand hauled equipment and supplies only.

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY

Check or highlight your answers so that the form may be submitted electronically returned by June 24, 2004.

Name: **John Robert Moody, EPH-2900**

Office: **PN, UCA, Ephrata Field Office**

Report on Project or projects: **COLUMBIA BASIN PROJECT - - - WEST CANAL**

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
Given all the projects with spillway features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your spillway structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> crest <input type="checkbox"/> gates <input type="checkbox"/> chute or tunnel invert <input type="checkbox"/> piers/divider walls <input type="checkbox"/> training Walls <input type="checkbox"/> flip bucket <input type="checkbox"/> stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> concrete deterioration <input type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfuction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
<b>Outlet Works Structure</b> Given all the projects with outlet works features that you oversee, what features cause you the most trouble? Check 3 most problematic <input type="checkbox"/> intake structure <input type="checkbox"/> pressurized pipe/conduit <input type="checkbox"/> crest <input type="checkbox"/> gates or valves <input type="checkbox"/> piers/divider walls <input type="checkbox"/> open channel pipe or chute invert <input type="checkbox"/> training walls <input type="checkbox"/> flip bucket <input type="checkbox"/> stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)		
What do you observe that causes the concerns you stated for your outlet works structure features? Check all that apply <input type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> concrete deterioration <input type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfuction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)		
What do you suspect are major contributing factors that jeopardize your systems ability to function? Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)		
<b>Conveyance Structure</b> Given all the projects with conveyance features that you oversee, what features cause you the most trouble? Check 3 most problematic <input type="checkbox"/> diversion or headworks <input type="checkbox"/> canals <input checked="" type="checkbox"/> canal lining (concrete, earthen, etc) <input type="checkbox"/> pipelines <input type="checkbox"/> pumping plant intake <input type="checkbox"/> pumping plant discharge <input type="checkbox"/> tunnels <input type="checkbox"/> siphons <input type="checkbox"/> underdrains <input type="checkbox"/> cross drainage <input type="checkbox"/> check structures <input type="checkbox"/> drop/ dissipating structures <input checked="" type="checkbox"/> foundation <input checked="" type="checkbox"/> other (specify): seepage & groundwater		
What do you observe that causes the concerns you stated for your conveyance structure features? Check all that apply <input checked="" type="checkbox"/> concrete cracking <input checked="" type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> concrete deterioration <input type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfuction <input type="checkbox"/> lack of flow through drains/plugging <input checked="" type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input checked="" type="checkbox"/> seepage <input type="checkbox"/> downstream channel erosion <input checked="" type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)		
What do you suspect are major contributing factors that jeopardize your systems ability to function? Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input checked="" type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> freeze/thaw cycles <input checked="" type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)		

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes	No
1	

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Design Deficiency

Yes	No
1	

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc. **\*\*\* Since first water in 1952, there have been problems with both capacity,**

**high groundwater, foundation soils, concrete panel buckling and cracking, etc. The intended design capacity from the Bifurcation to the W20 (20 mile)**

**check is 5100 cfs. However, designelevations are exceeded at 4600 cfs. Many concrete panels buckled and have since been replaced by the**

**Quincy-Columbia Basin Irrigation District(QCBID). The QCBID has accomplished extensive crack sealing on the Ephrata Reach of this high-risk canal.**

Please reference the attached issue paper for additional background.

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
1	

Comments: (over or use 2nd page) **Please reference the attached issue paper for additional background.**

## **BRIEFING PAPER**

**Prepared for:** Commissioner John Keys III Washington State

**Date:** March 05, 2004 (Revised June 24, 2004) **Bureau of Reclamation**

**TITLE:** Columbia Basin Project (CBP) - Aging Infrastructure

**ISSUE:** Many facilities in the CBP exceed 50 years of age with several of these beginning to require expensive maintenance to ensure the integrity of the facility. As an example, the West Canal through the Ephrata reach conveys up to 4,600 ft<sup>3</sup>/s during the peak of the irrigation season. Aging of this concrete-lined canal is evidenced by cracking and heaving of concrete panels and numerous seeps along the toe of the canal. This results in heightened concerns for the integrity of the West Canal, especially in populated areas. Reclamation owns the facilities, and the West Canal was transferred to the Quincy-Columbia Basin Irrigation District (QCBID) for operation and maintenance (O&M) in December 1968. At the request of the QCBID, Reclamation conducted a special review of operation and maintenance (RO&M) in December 2002 with follow-up walk through and observations during 2003. To better address QCBID's concerns, Reclamation provided the draft RO&M report to them for review and comment. However, the QCBID is not satisfied with the final RO&M report and stated in their February 5, 2004 letter that the report was not acceptable.

**BACKGROUND:** The West Canal was constructed in 1948 through 1951 with an intended design maximum capacity of 5,100 ft<sup>3</sup>/s to the W20 (20 mile) check. Much of the reach through the Ephrata area was constructed through basalt which was blasted and excavated. Fine-grained soil was then placed and trimmed to shape the prism for the slip-formed concrete lining. Inspections show that the soil material behind the concrete lining has been slumping, eroding, and/or piping away at numerous locations resulting in heaved and/or buckled concrete panels and increased seepage. A portion of the West Canal was constructed through a springs area immediately south of Ephrata, and this reach has a long history of seepage and high water table related problems.

A joint inspection by Reclamation and QCBID was accomplished in December 1967, and the inspection report was transmitted by Reclamation's January 22, 1968 letter. The inspection report indicated that lining repairs by Reclamation were adequate and no further work was planned outside of normal maintenance. To quote, "No further work is expected to be required under supplemental construction, however it is expected that lining maintenance will continue to be necessary because of foundation failures in isolated locations throughout the concrete lined portions of this canal." However, the QCBID continues to raise the issues of aging infrastructure, liability and safe capacity since the operational maximum canal capacity of 4,600 ft<sup>3</sup>/s begins exceeding the design elevation for maximum operational water surface. The QCBID claims that it cannot deliver

share system capacity without exceeding design elevation through the Ephrata reach due to bottlenecks downstream. The December 1968 contract requires Reclamation to deliver share system capacity for the developed platted acres. To satisfy the share system capacity of 3813 ft<sup>3</sup>/s at the 87 percent canal efficiency indicated by the contract requires Reclamation to convey at least 4383 ft<sup>3</sup>/s into the West Canal. However, unaccounted losses are greater than 13 percent for this concrete-lined reach.

During the 2001 and the 2002 irrigation seasons, visible seepage occurred at a number of locations along the Ephrata reach, more so than noted in previous years. In July 2002, seepage surfaced within Lions Park in Ephrata. During the winter of 2002-2003, the QCBID replaced numerous concrete panels, sealed cracks in the lining, and installed a toe drain in Lions Park. The effort proved successful and essentially eliminated all seepage at Lions Park and reduced seepage along the Ephrata-Oasis Park Reach during the 2003 irrigation season. During the winter of 2003-2004, the QCBID replaced additional panels and sealed more of the cracks, further reducing seepage during this irrigation season.

**BUREAU PERSPECTIVE:** Both Reclamation and the QCBID recognize the liability associated with this reach of the West Canal serving over 250,000 irrigated acres and the high groundwater condition impacting the canal. An O&M evaluation is needed to address the high degree of cracking and heaving that has plagued the West Canal through the reach from Ephrata to Winchester. The evaluation must include subsurface geology and methods to alleviate the detrimental high-groundwater conditions. A capacity evaluation is needed to evaluate flow constraints and bottlenecks occurring during the higher demand periods. The solutions for long-term fixes need to be developed through a Reclamation and QCBID partnership and should include repairs to improve facility longevity and system capacity.

**POSITION OF INTERESTED PARTIES:** The QCBID would like Reclamation to further address the discrepancy between the operational maximum capacity of 4,600 ft<sup>3</sup>/s and the design maximum capacity of 5,100 ft<sup>3</sup>/s. Also, the QCBID would like Reclamation to re-institute the Rehabilitation and Betterment Program or to develop a similar loan program that will provide the financing necessary for rebuilding and replacing aging infrastructure.

**CONTACT:** William Gray, Deputy Area Manager, Upper Columbia Area (Ephrata Field Office)  
(509) 754-0214 or John R. Moody, Manager, Irrigation Operations and Technical Services Division (Ephrata Field Office) 509-754-0243.

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Randy Harris

Office: PN Dive Team

Report on Project or projects:

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
Given all the projects with spillway features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your spillway structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> crest <input checked="" type="checkbox"/> 1 gates <input type="checkbox"/> chute or tunnel invert <input type="checkbox"/> piers/divider walls <input type="checkbox"/> training Walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> 1 stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> 1 concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input checked="" type="checkbox"/> 1 other (specify) Rock Debris in stilling basin	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Outlet Works Structure		
Given all the projects with outlet works features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your outlet works structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input checked="" type="checkbox"/> 1 intake structure <input type="checkbox"/> pressurized pipe/conduit <input type="checkbox"/> crest <input checked="" type="checkbox"/> 1 gates or valves <input type="checkbox"/> piers/divider walls <input type="checkbox"/> open channel pipe or chute invert <input type="checkbox"/> training walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> 1 stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input checked="" type="checkbox"/> 1 bank sloughing intake structure <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input checked="" type="checkbox"/> 1 other (specify) Rock debris organic debris on intake racks gate stem guide failure	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Conveyance Structure		
Given all the projects with conveyance features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your conveyance structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> diversion or headworks <input checked="" type="checkbox"/> 1 canals <input checked="" type="checkbox"/> 1 canal lining (concrete, earthen, etc) <input type="checkbox"/> pipelines <input checked="" type="checkbox"/> 1 pumping plant intake <input type="checkbox"/> pumping plant discharge <input checked="" type="checkbox"/> 1 tunnels <input checked="" type="checkbox"/> 1 siphons <input type="checkbox"/> underdrains <input type="checkbox"/> cross drainage <input type="checkbox"/> check structures <input type="checkbox"/> drop/ dissipating structures <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input checked="" type="checkbox"/> 1 slab movement or offsets <input type="checkbox"/> concrete deterioration <input type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> seepage <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input checked="" type="checkbox"/> 1 other (specify) corrosion from rust and dissimilar metals	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

Yes No

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes No

<input type="checkbox"/>	<input type="checkbox"/>
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Comments: (over or use 2nd page)



# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY

Check or highlight your answers so that the form may be submitted electronically returned by June 24, 2004.

Name: Tony A. Hargroves

Office: Yakima Field Office

Report on Project or projects: PN - Bumping Lake Dam

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
Given all the projects with spillway features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your spillway structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input checked="" type="checkbox"/> 1 crest <input type="checkbox"/> gates <input type="checkbox"/> chute or tunnel invert <input type="checkbox"/> piers/divider walls <input type="checkbox"/> training Walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> 1 stilling basin/plunge pool <input checked="" type="checkbox"/> 1 drains <input checked="" type="checkbox"/> 1 downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> 1 concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input checked="" type="checkbox"/> 1 lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input checked="" type="checkbox"/> 1 downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> 1 freeze/thaw cycles <input checked="" type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Outlet Works Structure		
Given all the projects with outlet works features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your outlet works structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> intake structure <input type="checkbox"/> pressurized pipe/conduit <input type="checkbox"/> crest <input checked="" type="checkbox"/> 1 gates or valves <input type="checkbox"/> piers/divider walls <input checked="" type="checkbox"/> 1 open channel pipe or chute invert <input type="checkbox"/> training walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> 1 stilling basin/plunge pool <input type="checkbox"/> drains <input checked="" type="checkbox"/> 1 downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> 1 concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input checked="" type="checkbox"/> 1 lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input checked="" type="checkbox"/> 1 downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> 1 freeze/thaw cycles <input checked="" type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input checked="" type="checkbox"/> 1 reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Conveyance Structure		
Given all the projects with conveyance features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your conveyance structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> diversion or headworks <input checked="" type="checkbox"/> 1 canals <input checked="" type="checkbox"/> 1 canal lining (concrete, earthen, etc) <input type="checkbox"/> pipelines <input type="checkbox"/> pumping plant intake <input type="checkbox"/> pumping plant discharge <input checked="" type="checkbox"/> 1 tunnels <input checked="" type="checkbox"/> 1 siphons <input type="checkbox"/> underdrains <input checked="" type="checkbox"/> 1 cross drainage <input type="checkbox"/> check structures <input type="checkbox"/> drop/ dissipating structures <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> 1 concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input checked="" type="checkbox"/> 1 lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> seepage <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> 1 freeze/thaw cycles <input checked="" type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input checked="" type="checkbox"/> 1 reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page)

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY

Check or highlight your answers so that the form may be submitted electronically returned by June 24, 2004.

Name: Tony A. Hargroves

Office: Yakima Field Office

Report on Project or projects: PN - Clear Creek Dam

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input checked="" type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> gates	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> chute or tunnel invert	<input checked="" type="checkbox"/> concrete deterioration	<input checked="" type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> piers/divider walls	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input checked="" type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input checked="" type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input checked="" type="checkbox"/> downstream outlet channel	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input checked="" type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)

Outlet Works Structure		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> intake structure	<input checked="" type="checkbox"/> concrete cracking	<input checked="" type="checkbox"/> high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete deterioration	<input checked="" type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> gates or valves	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input checked="" type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> submerged water environment
<input checked="" type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input checked="" type="checkbox"/> downstream channel erosion	<input checked="" type="checkbox"/> reinforcement corrosion
<input checked="" type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> other (specify)		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)

Conveyance Structure		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> diversion or headworks	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> canals	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> canal lining (concrete, earthen, etc)	<input checked="" type="checkbox"/> concrete deterioration	<input checked="" type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> pipelines	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input checked="" type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> tunnels	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input checked="" type="checkbox"/> siphons	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input checked="" type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input checked="" type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.


Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page)

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# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY

Check or highlight your answers so that the form may be submitted electronically returned by June 24, 2004.

Name: Tony A. Hargroves

Office: Yakima Field Office

Report on Project or projects: PN - Keechelus Dam

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
Given all the projects with spillway features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your spillway structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input checked="" type="checkbox"/> crest <input type="checkbox"/> gates <input type="checkbox"/> chute or tunnel invert <input type="checkbox"/> piers/divider walls <input type="checkbox"/> training Walls <input type="checkbox"/> flip bucket <input type="checkbox"/> stilling basin/plunge pool <input checked="" type="checkbox"/> drains <input checked="" type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> concrete deterioration <input checked="" type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input checked="" type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input checked="" type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> freeze/thaw cycles <input checked="" type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Outlet Works Structure		
Given all the projects with outlet works features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your outlet works structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> intake structure <input type="checkbox"/> pressurized pipe/conduit <input type="checkbox"/> crest <input checked="" type="checkbox"/> gates or valves <input type="checkbox"/> piers/divider walls <input checked="" type="checkbox"/> open channel pipe or chute invert <input type="checkbox"/> training walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> stilling basin/plunge pool <input type="checkbox"/> drains <input checked="" type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> concrete deterioration <input checked="" type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input checked="" type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input checked="" type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> freeze/thaw cycles <input checked="" type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input checked="" type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Conveyance Structure		
Given all the projects with conveyance features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your conveyance structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> diversion or headworks <input checked="" type="checkbox"/> canals <input checked="" type="checkbox"/> canal lining (concrete, earthen, etc) <input type="checkbox"/> pipelines <input type="checkbox"/> pumping plant intake <input type="checkbox"/> pumping plant discharge <input checked="" type="checkbox"/> tunnels <input checked="" type="checkbox"/> siphons <input type="checkbox"/> underdrains <input checked="" type="checkbox"/> cross drainage <input type="checkbox"/> check structures <input type="checkbox"/> drop/ dissipating structures <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> concrete deterioration <input checked="" type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input checked="" type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> seepage <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> freeze/thaw cycles <input checked="" type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input checked="" type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page)

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY

Check or highlight your answers so that the form may be submitted electronically returned by June 24, 2004.

Name: Tony A. Hargroves

Office: Yakima Field Office

Report on Project or projects: PN - Kachess Dam

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
Given all the projects with spillway features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your spillway structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> crest <input checked="" type="checkbox"/> 1 gates <input type="checkbox"/> 1 chute or tunnel invert <input type="checkbox"/> piers/divider walls <input type="checkbox"/> training Walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> 1 stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> 1 concrete deterioration <input type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> 1 lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> 1 downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> 1 freeze/thaw cycles <input type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Outlet Works Structure		
Given all the projects with outlet works features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your outlet works structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> intake structure <input type="checkbox"/> pressurized pipe/conduit <input type="checkbox"/> crest <input type="checkbox"/> 1 gates or valves <input type="checkbox"/> piers/divider walls <input checked="" type="checkbox"/> 1 open channel pipe or chute invert <input type="checkbox"/> training walls <input type="checkbox"/> flip bucket <input type="checkbox"/> stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> 1 downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> 1 concrete deterioration <input type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> 1 downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> 1 freeze/thaw cycles <input type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> 1 submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> 1 reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Conveyance Structure		
Given all the projects with conveyance features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your conveyance structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> diversion or headworks <input checked="" type="checkbox"/> 1 canals <input type="checkbox"/> 1 canal lining (concrete, earthen, etc) <input type="checkbox"/> pipelines <input type="checkbox"/> pumping plant intake <input type="checkbox"/> pumping plant discharge <input type="checkbox"/> 1 tunnels <input type="checkbox"/> 1 siphons <input type="checkbox"/> underdrains <input type="checkbox"/> 1 cross drainage <input type="checkbox"/> check structures <input type="checkbox"/> drop/ dissipating structures <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> 1 concrete deterioration <input type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> 1 lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> seepage <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input type="checkbox"/> 1 freeze/thaw cycles <input type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> 1 reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/> 1

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.


Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page)


# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY

Check or highlight your answers so that the form may be submitted electronically returned by June 24, 2004.

Name: Tony A. Hargroves

Office: Yakima Field Office

Report on Project or projects: Tieton Dam

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
Given all the projects with spillway features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your spillway structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> crest <input checked="" type="checkbox"/> 1 gates <input type="checkbox"/> 1 chute or tunnel invert <input type="checkbox"/> piers/divider walls <input type="checkbox"/> training Walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> 1 stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> 1 concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input checked="" type="checkbox"/> 1 lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input checked="" type="checkbox"/> 1 downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> 1 freeze/thaw cycles <input checked="" type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Outlet Works Structure		
Given all the projects with outlet works features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your outlet works structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> intake structure <input type="checkbox"/> pressurized pipe/conduit <input type="checkbox"/> crest <input checked="" type="checkbox"/> 1 gates or valves <input type="checkbox"/> piers/divider walls <input checked="" type="checkbox"/> 1 open channel pipe or chute invert <input type="checkbox"/> training walls <input type="checkbox"/> flip bucket <input type="checkbox"/> stilling basin/plunge pool <input type="checkbox"/> drains <input checked="" type="checkbox"/> 1 downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> 1 concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input checked="" type="checkbox"/> 1 downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> 1 freeze/thaw cycles <input checked="" type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input checked="" type="checkbox"/> 1 reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Conveyance Structure		
Given all the projects with conveyance features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your conveyance structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> diversion or headworks <input checked="" type="checkbox"/> 1 canals <input checked="" type="checkbox"/> 1 canal lining (concrete, earthen, etc) <input type="checkbox"/> pipelines <input type="checkbox"/> pumping plant intake <input type="checkbox"/> pumping plant discharge <input checked="" type="checkbox"/> 1 tunnels <input checked="" type="checkbox"/> 1 siphons <input type="checkbox"/> underdrains <input checked="" type="checkbox"/> 1 cross drainage <input type="checkbox"/> check structures <input type="checkbox"/> drop/ dissipating structures <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> 1 concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input checked="" type="checkbox"/> 1 lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> seepage <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> 1 freeze/thaw cycles <input checked="" type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input checked="" type="checkbox"/> 1 reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page)

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY

Check or highlight your answers so that the form may be submitted electronically returned by June 24, 2004.

Name: Tony A. Hargroves

Office: Yakima Field Office

Report on Project or projects: PN - Cle Elum Dam

(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> gates	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> chute or tunnel invert	<input checked="" type="checkbox"/> concrete deterioration	<input checked="" type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> piers/divider walls	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input checked="" type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input checked="" type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Outlet Works Structure</b>		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> intake structure	<input checked="" type="checkbox"/> concrete cracking	<input checked="" type="checkbox"/> high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete deterioration	<input checked="" type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> gates or valves	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input checked="" type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> submerged water environment
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input checked="" type="checkbox"/> downstream channel erosion	<input checked="" type="checkbox"/> reinforcement corrosion
<input checked="" type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> other (specify)		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Conveyance Structure</b>		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> diversion or headworks	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> canals	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> canal lining (concrete, earthen, etc)	<input checked="" type="checkbox"/> concrete deterioration	<input checked="" type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> pipelines	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input checked="" type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> tunnels	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input checked="" type="checkbox"/> siphons	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input checked="" type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input checked="" type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.


Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page)

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**RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003**

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Dan GrundvigOffice: UC Region

Report on Project or projects: \_\_\_\_\_

All

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

<b>Spillway Structure</b> (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> gates	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> chute or tunnel invert	<input checked="" type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input checked="" type="checkbox"/> training Walls	<input checked="" type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> bank sloughing	<input checked="" type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
		<input checked="" type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Outlet Works Structure</b>		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> intake structure	<input type="checkbox"/> concrete cracking	<input checked="" type="checkbox"/> high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> gates or valves	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input checked="" type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input checked="" type="checkbox"/> other (specify) age/deterioration of gates & valves	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> other (specify)		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Conveyance Structure</b>		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> diversion or headworks	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> canals	<input checked="" type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> canal lining (concrete, earthen, etc)	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> pipelines	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input checked="" type="checkbox"/> soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input checked="" type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> tunnels	<input type="checkbox"/> inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> siphons	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> cross drainage	<input checked="" type="checkbox"/> seepage	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input checked="" type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes	No
<input checked="" type="checkbox"/> 1	<input type="checkbox"/>

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

Scofield Dam/Scofield Project, UTSpillway concrete is rapidly deteriorating. Repairs have been unsuccessful! Presently being evaluated by TSC. Report of Findingsdue Dame Safety Decision Document is Pending

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/> 1

Comments: (over or use 2nd page)

**RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003**

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Anthony VigilOffice: Albuquerque Area Office

Report on Project or projects: \_\_\_\_\_

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

<b>Spillway Structure</b> (either concrete or earthen)		
<b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your spillway structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> gates	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> chute or tunnel invert	<input checked="" type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> piers/divider walls	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input checked="" type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> submerged water environment
<input type="checkbox"/> downstream outlet channel	<input checked="" type="checkbox"/> bank sloughing	<input checked="" type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input type="checkbox"/> downstream channel erosion	<input checked="" type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify)	<input checked="" type="checkbox"/> reactive concrete aggregate
		<input checked="" type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Outlet Works Structure</b>		
<b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your outlet works structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input checked="" type="checkbox"/> intake structure	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input checked="" type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input checked="" type="checkbox"/> gates or valves	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input checked="" type="checkbox"/> soil or foundation related
<input type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> submerged water environment
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input checked="" type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> other (specify)	<input checked="" type="checkbox"/> sediment Buildup	<input type="checkbox"/> unsuccessful concrete repair
	<input checked="" type="checkbox"/> aging/deterioration & worn seals	<input type="checkbox"/> other (specify)
<b>Conveyance Structure</b>		
<b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b>	<b>What do you observe that causes the concerns you stated for your conveyance structure features?</b>	<b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b>
Check 3 most problematic	Check all that apply	Check all that apply
<input checked="" type="checkbox"/> diversion or headworks	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> canals	<input checked="" type="checkbox"/> slab movement or offsets	<input checked="" type="checkbox"/> high energy dissipation
<input checked="" type="checkbox"/> canal lining (concrete, earthen, etc)	<input checked="" type="checkbox"/> concrete deterioration	<input checked="" type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> pipelines	<input checked="" type="checkbox"/> concrete abrasion/erosion	<input checked="" type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input checked="" type="checkbox"/> soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input type="checkbox"/> lack of flow through drains/plugging	<input checked="" type="checkbox"/> freeze/thaw cycles
<input checked="" type="checkbox"/> tunnels	<input type="checkbox"/> inadequate capacity	<input checked="" type="checkbox"/> normal aging/deterioration
<input checked="" type="checkbox"/> siphons	<input type="checkbox"/> inadequate control	<input checked="" type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input type="checkbox"/> bank sloughing	<input checked="" type="checkbox"/> poor concrete quality
<input type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input type="checkbox"/> reinforcement corrosion
<input checked="" type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input checked="" type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc. \_\_\_\_\_

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

Comments: (over or use 2nd page) \_\_\_\_\_



# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Glenn Stone, Facilities Maintenance Group Chief

Office: Western Colorado Area Office - Grand Junction CO

Report on Project or projects:

All

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
Given all the projects with spillway features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your spillway structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input checked="" type="checkbox"/> 1 crest <input type="checkbox"/> gates <input checked="" type="checkbox"/> 1 chute or tunnel invert <input type="checkbox"/> piers/divider walls <input type="checkbox"/> training Walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> 1 stilling basin/plunge pool <input type="checkbox"/> drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input checked="" type="checkbox"/> 1 concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input type="checkbox"/> soil or foundation related <input checked="" type="checkbox"/> 1 freeze/thaw cycles <input checked="" type="checkbox"/> 1 normal aging/deterioration <input type="checkbox"/> submerged water environment <input checked="" type="checkbox"/> 1 poor concrete quality <input checked="" type="checkbox"/> 1 reinforcement corrosion <input type="checkbox"/> structural overloading <input checked="" type="checkbox"/> 1 reactive concrete aggregate <input checked="" type="checkbox"/> 1 unsuccessful concrete repair <input type="checkbox"/> other (specify)
Outlet Works Structure		
Given all the projects with outlet works features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your outlet works structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> intake structure <input type="checkbox"/> pressurized pipe/conduit <input type="checkbox"/> crest <input checked="" type="checkbox"/> 1 gates or valves <input type="checkbox"/> piers/divider walls <input type="checkbox"/> open channel pipe or chute invert <input type="checkbox"/> training walls <input type="checkbox"/> flip bucket <input checked="" type="checkbox"/> 1 stilling basin/plunge pool <input checked="" type="checkbox"/> 1 drains <input type="checkbox"/> downstream outlet channel <input type="checkbox"/> foundation <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> concrete deterioration <input checked="" type="checkbox"/> 1 concrete abrasion/erosion <input checked="" type="checkbox"/> 1 gate binding/malfunction <input checked="" type="checkbox"/> 1 lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input type="checkbox"/> bank sloughing <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input checked="" type="checkbox"/> 1 concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input checked="" type="checkbox"/> 1 soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)
Conveyance Structure		
Given all the projects with conveyance features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your conveyance structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic <input type="checkbox"/> diversion or headworks <input checked="" type="checkbox"/> 1 canals <input checked="" type="checkbox"/> 1 canal lining (concrete, earthen, etc) <input type="checkbox"/> pipelines <input type="checkbox"/> pumping plant intake <input type="checkbox"/> pumping plant discharge <input type="checkbox"/> tunnels <input type="checkbox"/> siphons <input type="checkbox"/> underdrains <input type="checkbox"/> cross drainage <input type="checkbox"/> check structures <input type="checkbox"/> drop/ dissipating structures <input checked="" type="checkbox"/> 1 foundation <input type="checkbox"/> other (specify)	Check all that apply <input checked="" type="checkbox"/> 1 concrete cracking <input type="checkbox"/> slab movement or offsets <input type="checkbox"/> concrete deterioration <input type="checkbox"/> concrete abrasion/erosion <input type="checkbox"/> gate binding/malfunction <input type="checkbox"/> lack of flow through drains/plugging <input type="checkbox"/> inadequate capacity <input type="checkbox"/> inadequate control <input checked="" type="checkbox"/> 1 bank sloughing <input checked="" type="checkbox"/> 1 seepage <input type="checkbox"/> downstream channel erosion <input type="checkbox"/> failure of foundation or concrete <input type="checkbox"/> other (specify)	Check all that apply <input type="checkbox"/> high velocity flow <input type="checkbox"/> high energy dissipation <input type="checkbox"/> concrete erosion by abrasion <input type="checkbox"/> hydro static pressure <input checked="" type="checkbox"/> 1 soil or foundation related <input type="checkbox"/> freeze/thaw cycles <input type="checkbox"/> normal aging/deterioration <input type="checkbox"/> submerged water environment <input type="checkbox"/> poor concrete quality <input type="checkbox"/> reinforcement corrosion <input type="checkbox"/> structural overloading <input type="checkbox"/> reactive concrete aggregate <input type="checkbox"/> unsuccessful concrete repair <input type="checkbox"/> other (specify)

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Yes No

☒ 1 ☐

Not yet

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc. Uncompahgre Project (Taylor Park Dam)--a significant portion of the spillway

crest concrete is deteriorating. Repairs have been attempted over the last 20 years, but most of the repairs have failed. Because the spillway faces

south and is located a high elevation, the cause could be freeze/thaw (although the cause has not been determined).

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes No

☒ 1 ☐

Comments: (over or use 2nd page) This particular problem (at Taylor Park Dam) has also been submitted as a candidate to Kepler/VonFay for

their "Concrete and Concrete Repair Demonstration Program".

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Ed Vidmar

Office: Provo Area Office

Report on Project or projects:

All

(i.e. All or list specific project(s))

Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
<p><b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> crest</p> <p><input type="checkbox"/> gates</p> <p><input checked="" type="checkbox"/> chute or tunnel invert</p> <p><input checked="" type="checkbox"/> piers/divider walls</p> <p><input type="checkbox"/> training Walls</p> <p><input type="checkbox"/> flip bucket</p> <p><input checked="" type="checkbox"/> stilling basin/plunge pool</p> <p><input type="checkbox"/> drains</p> <p><input type="checkbox"/> downstream outlet channel</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you observe that causes the concerns you stated for your spillway structure features?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> concrete cracking</p> <p><input checked="" type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input checked="" type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input checked="" type="checkbox"/> high energy dissipation</p> <p><input checked="" type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input type="checkbox"/> soil or foundation related</p> <p><input checked="" type="checkbox"/> freeze/thaw cycles</p> <p><input type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>
<p><b>Outlet Works Structure</b></p> <p><b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> intake structure</p> <p><input type="checkbox"/> pressurized pipe/conduit</p> <p><input type="checkbox"/> crest</p> <p><input checked="" type="checkbox"/> gates or valves</p> <p><input type="checkbox"/> piers/divider walls</p> <p><input type="checkbox"/> open channel pipe or chute invert</p> <p><input type="checkbox"/> training walls</p> <p><input type="checkbox"/> flip bucket</p> <p><input checked="" type="checkbox"/> stilling basin/plunge pool</p> <p><input type="checkbox"/> drains</p> <p><input type="checkbox"/> downstream outlet channel</p> <p><input type="checkbox"/> foundation</p> <p><input checked="" type="checkbox"/> other (specify)</p>		
<p><b>What do you observe that causes the concerns you stated for your outlet works structure features?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> concrete cracking</p> <p><input type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input checked="" type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input type="checkbox"/> other (specify)</p>		
<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input checked="" type="checkbox"/> high velocity flow</p> <p><input checked="" type="checkbox"/> high energy dissipation</p> <p><input checked="" type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input type="checkbox"/> soil or foundation related</p> <p><input checked="" type="checkbox"/> freeze/thaw cycles</p> <p><input type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>		
<p><b>Conveyance Structure</b></p> <p><b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> diversion or headworks</p> <p><input checked="" type="checkbox"/> canals</p> <p><input checked="" type="checkbox"/> canal lining (concrete, earthen, etc)</p> <p><input type="checkbox"/> pipelines</p> <p><input type="checkbox"/> pumping plant intake</p> <p><input type="checkbox"/> pumping plant discharge</p> <p><input type="checkbox"/> tunnels</p> <p><input type="checkbox"/> siphons</p> <p><input checked="" type="checkbox"/> underdrains</p> <p><input checked="" type="checkbox"/> cross drainage</p> <p><input type="checkbox"/> check structures</p> <p><input type="checkbox"/> drop/ dissipating structures</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>		
<p><b>What do you observe that causes the concerns you stated for your conveyance structure features?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> concrete cracking</p> <p><input checked="" type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input checked="" type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input checked="" type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> seepage</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input checked="" type="checkbox"/> other (specify) <b>Urbanization</b></p>		
<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input type="checkbox"/> concrete erosion by abrasion</p> <p><input checked="" type="checkbox"/> hydro static pressure</p> <p><input type="checkbox"/> soil or foundation related</p> <p><input checked="" type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>		

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

Scofield Dam Spillway deterioration

time frame you have been dealing with problem, probable cause, etc.

All 11 years I have been here.

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>

Comments: (over or use 2nd page)

# RECLAMATION SPILLWAY, OUTLET WORKS AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Brad Dodd

Office: WCAO-Durango

Report on Project or projects: emon, McPhee, Great Cut Dike, Jackson Gulch, Hammond Project, Paradi  
(i.e. All or list specific project(s)) Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

Spillway Structure (either concrete or earthen)		
<p><b>Given all the projects with spillway features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> crest</p> <p><input type="checkbox"/> gates</p> <p><input checked="" type="checkbox"/> chute or tunnel invert</p> <p><input type="checkbox"/> piers/divider walls</p> <p><input checked="" type="checkbox"/> training Walls</p> <p><input type="checkbox"/> flip bucket</p> <p><input type="checkbox"/> stilling basin/plunge pool</p> <p><input type="checkbox"/> drains</p> <p><input checked="" type="checkbox"/> downstream outlet channel</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you observe that causes the concerns you stated for your spillway structure features?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> concrete cracking</p> <p><input checked="" type="checkbox"/> slab movement or offsets</p> <p><input checked="" type="checkbox"/> concrete deterioration</p> <p><input type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input type="checkbox"/> other (specify)</p>	<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input checked="" type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input checked="" type="checkbox"/> soil or foundation related</p> <p><input type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input checked="" type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>
<p><b>Outlet Works Structure</b></p> <p><b>Given all the projects with outlet works features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> intake structure</p> <p><input checked="" type="checkbox"/> pressurized pipe/conduit</p> <p><input type="checkbox"/> crest</p> <p><input checked="" type="checkbox"/> gates or valves</p> <p><input type="checkbox"/> piers/divider walls</p> <p><input type="checkbox"/> open channel pipe or chute invert</p> <p><input type="checkbox"/> training walls</p> <p><input type="checkbox"/> flip bucket</p> <p><input type="checkbox"/> stilling basin/plunge pool</p> <p><input checked="" type="checkbox"/> drains</p> <p><input type="checkbox"/> downstream outlet channel</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>		
<p><b>Conveyance Structure</b></p> <p><b>Given all the projects with conveyance features that you oversee, what features cause you the most trouble?</b></p> <p>Check 3 most problematic</p> <p><input type="checkbox"/> diversion or headworks</p> <p><input type="checkbox"/> canals</p> <p><input checked="" type="checkbox"/> canal lining (concrete, earthen, etc)</p> <p><input type="checkbox"/> pipelines</p> <p><input type="checkbox"/> pumping plant intake</p> <p><input type="checkbox"/> pumping plant discharge</p> <p><input type="checkbox"/> tunnels</p> <p><input checked="" type="checkbox"/> siphons</p> <p><input type="checkbox"/> underdrains</p> <p><input checked="" type="checkbox"/> cross drainage</p> <p><input type="checkbox"/> check structures</p> <p><input type="checkbox"/> drop/ dissipating structures</p> <p><input type="checkbox"/> foundation</p> <p><input type="checkbox"/> other (specify)</p>		
<p><b>What do you observe that causes the concerns you stated for your conveyance structure features?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> concrete cracking</p> <p><input type="checkbox"/> slab movement or offsets</p> <p><input type="checkbox"/> concrete deterioration</p> <p><input type="checkbox"/> concrete abrasion/erosion</p> <p><input type="checkbox"/> gate binding/malfunction</p> <p><input checked="" type="checkbox"/> lack of flow through drains/plugging</p> <p><input type="checkbox"/> inadequate capacity</p> <p><input type="checkbox"/> inadequate control</p> <p><input type="checkbox"/> bank sloughing</p> <p><input checked="" type="checkbox"/> seepage</p> <p><input type="checkbox"/> downstream channel erosion</p> <p><input type="checkbox"/> failure of foundation or concrete</p> <p><input type="checkbox"/> other (specify)</p>		
<p><b>What do you suspect are major contributing factors that jeopardize your systems ability to function?</b></p> <p>Check all that apply</p> <p><input type="checkbox"/> high velocity flow</p> <p><input type="checkbox"/> high energy dissipation</p> <p><input type="checkbox"/> concrete erosion by abrasion</p> <p><input type="checkbox"/> hydro static pressure</p> <p><input checked="" type="checkbox"/> soil or foundation related</p> <p><input checked="" type="checkbox"/> freeze/thaw cycles</p> <p><input checked="" type="checkbox"/> normal aging/deterioration</p> <p><input type="checkbox"/> submerged water environment</p> <p><input type="checkbox"/> poor concrete quality</p> <p><input type="checkbox"/> reinforcement corrosion</p> <p><input type="checkbox"/> structural overloading</p> <p><input type="checkbox"/> reactive concrete aggregate</p> <p><input type="checkbox"/> unsuccessful concrete repair</p> <p><input type="checkbox"/> other (specify)</p>		

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Comments: (over or use 2nd page)

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

# **RECLAMATION SPILLWAY, OUTLET WORKS-AND CONVEYANCE STRUCTURE SCREENING SURVEY - 2003**

Check or highlight your answers so that the form may be submitted electronically returned by October 9, 2003.

Name: Bob Major

Office: Western CO. Area Office

Report on Project or projects:  
(i.e. All or list specific project(s))

ollbran, Paonia, Silt, Grand Valley, Smith Fork, Bostwick Park, Fruitgrowers Dam, Dallas Creek, Uncompahgre  
Please make more sheets (or use Excel tabs) if you want to indicate specific problems on an individual project basis.

<b>Spillway Structure</b> (either concrete or earthen)		
Given all the projects with spillway features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your spillway structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic	Check all that apply	Check all that apply
<input checked="" type="checkbox"/> crest	<input checked="" type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> gates	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> chute or tunnel invert	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> training Walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> flip bucket	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> drains	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> foundation	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> other (specify)	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
	<input type="checkbox"/> other (specify) - accumulation of sediment & rock in stilling basin and d/s channel from rock fall and hillside sloughing.	<input type="checkbox"/> reactive concrete aggregate
		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify) poor construction practices:rebar too close to surfaces etc
<b>Outlet Works Structure</b>		
Given all the projects with outlet works features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your outlet works structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> intake structure	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> pressurized pipe/conduit	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> crest	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> gates or valves	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> piers/divider walls	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> open channel pipe or chute invert	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> training walls	<input type="checkbox"/> inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> flip bucket	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> stilling basin/plunge pool	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> drains	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> downstream outlet channel	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> structural overloading
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> other (specify)		<input type="checkbox"/> unsuccessful concrete repair
		<input type="checkbox"/> other (specify)
<b>Conveyance Structure</b>		
Given all the projects with conveyance features that you oversee, what features cause you the most trouble?	What do you observe that causes the concerns you stated for your conveyance structure features?	What do you suspect are major contributing factors that jeopardize your systems ability to function?
Check 3 most problematic	Check all that apply	Check all that apply
<input type="checkbox"/> diversion or headworks	<input type="checkbox"/> concrete cracking	<input type="checkbox"/> high velocity flow
<input type="checkbox"/> canals	<input type="checkbox"/> slab movement or offsets	<input type="checkbox"/> high energy dissipation
<input type="checkbox"/> canal lining (concrete, earthen, etc)	<input type="checkbox"/> concrete deterioration	<input type="checkbox"/> concrete erosion by abrasion
<input type="checkbox"/> pipelines	<input type="checkbox"/> concrete abrasion/erosion	<input type="checkbox"/> hydro static pressure
<input type="checkbox"/> pumping plant intake	<input type="checkbox"/> gate binding/malfunction	<input type="checkbox"/> soil or foundation related
<input type="checkbox"/> pumping plant discharge	<input type="checkbox"/> lack of flow through drains/plugging	<input type="checkbox"/> freeze/thaw cycles
<input type="checkbox"/> tunnels	<input type="checkbox"/> inadequate capacity	<input type="checkbox"/> normal aging/deterioration
<input type="checkbox"/> siphons	<input type="checkbox"/> inadequate control	<input type="checkbox"/> submerged water environment
<input type="checkbox"/> underdrains	<input type="checkbox"/> bank sloughing	<input type="checkbox"/> poor concrete quality
<input type="checkbox"/> cross drainage	<input type="checkbox"/> seepage	<input type="checkbox"/> reinforcement corrosion
<input type="checkbox"/> check structures	<input type="checkbox"/> downstream channel erosion	<input type="checkbox"/> structural overloading
<input type="checkbox"/> drop/ dissipating structures	<input type="checkbox"/> failure of foundation or concrete	<input type="checkbox"/> reactive concrete aggregate
<input type="checkbox"/> foundation	<input type="checkbox"/> other (specify)-landslides	<input type="checkbox"/> unsuccessful concrete repair
<input type="checkbox"/> other (specify)		<input type="checkbox"/> other (specify)-drop chute designs & structures constructed in

Have you had a continued maintenance problem associated with a spillway, outlet works, or conveyance structure on any of your projects?

If yes, has this continued problem lead to the inability of your structure to pass flow or make deliveries.

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

not generally or brief

If yes, please give the project name, and a description of the problem including the type of structure with the problem,

time frame you have been dealing with problem, probable cause, etc.

Would you be interested in having the problem described above addressed as a demonstration project of a new technology for repair or redesign?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Glenn Stone of this office submitted the concrete problems at Taylor Park Dam for such a thing already.

Comments: (over or use 2nd page)