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Federal Energy Regulatory Commission Record Research Tool

Version 1.0 - Effects of Flow and Water Level Fluctuations on Environmental Resources

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Technical Update, November 2014

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PRODUCT DESCRIPTION

The Federal Energy Regulatory Commission (FERC) Record Research Tool is a spreadsheet-based tool designed to assist users with identifying and accessing relevant information from FERC's public record system (eLibrary). Version 1.0 described in this report focuses on studies, reports, and other information related to the effects of flow and water level fluctuations on environmental resources in impoundments and riverine areas. The spreadsheet tool could easily be expanded to include information relevant to other resources and issues.

Background

FERC's hydropower licensing process requires applicants to consult with stakeholders to identify issues of potential concern and gather information on the environmental effects of the proposed licensing actions. Over the past several decades, this process has produced a vast amount of information in hundreds of licensing proceedings, and the majority of this information is available via the internet through eLibrary. Accessing relevant information from this record can help the owners and developers of hydroelectric projects engaged in the licensing process to address issues using existing, available information, and to better focus and/or reduce the scope of site-specific studies that may be needed.

Objectives

- To assist hydroelectric licensing applicants with identifying other licensing proceedings that addressed similar issues of concern.
- To facilitate access to information that is relevant to these issues.
- To identify areas where the spreadsheet tool could be expanded to provide the greatest benefit to members of the Electric Power Research Institute (EPRI) Waterpower Program.

Approach

The project team downloaded and reviewed all of the environmental assessments and environmental impact statements issued by FERC since January 1, 2000 to identify the issues addressed in recent licensing proceedings. These documents analyze the environmental effects of a proposed licensing action, and assess the costs and benefits of measures proposed by the applicant or recommended by other stakeholders in each proceeding. FERC uses the analysis to support its decisions on what measures are appropriate for inclusion in a hydropower license, while considering their environmental effects as required by the National Environmental Policy Act (NEPA). The project team then reviewed relevant sections of each NEPA document to identify the issues addressed and the reports and references cited in the analysis of environmental effects associated with fluctuating flows and water levels. This information was entered into a filterable spreadsheet application that allows the user to conduct keyword searches to identify projects where similar issues were addressed, and to access the NEPA documents and resulting license order via hyperlink or accession number. A separate tab on the spreadsheet, which can also be filtered using keyword searches, provides a listing of relevant citations identified from the NEPA documents.

Results

The filterable spreadsheet includes hyperlinks and accession numbers for 281 NEPA documents that were issued to support licensing decisions on 356 hydroelectric projects, some of which address multiple hydroelectric developments that may be included within a single license. The

research identified substantive analyses of the effects of flow and water level fluctuations on environmental resources in impoundments associated with 70 FERC projects, and analyses of effects on riverine resources associated with 117 FERC projects. The project team also compiled a list of 524 full citations of the reports cited in these analyses. The spreadsheet can be easily filtered to identify other licensing proceedings that have addressed a specific issue of concern, and most of these citations can be easily accessed from eLibrary by searching for the title of the citation.

Applications, Value, and Use

The spreadsheet tool is designed to help hydroelectric licensing applicants identify and access existing information from past licensing proceedings that may be of value in ongoing and future proceedings. Access to this information can reduce the number and cost of studies, and can better focus studies necessary to address site-specific considerations.

Keywords

Hydroelectric
Licensing
Environmental effects
Flow fluctuations
Water level fluctuations
Data mining

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1
PURPOSE

The Federal Energy Regulatory Commission (FERC)'s hydropower licensing process requires applicants to consult with stakeholders to identify issues of potential concern and to gather information on the environmental effects of proposed licensing actions. Over the past several decades, a vast amount of information has been developed in hundreds of licensing proceedings, and the majority of this information is available via the internet through FERC's public record system (eLibrary).

The spreadsheet tool developed in this project is intended to help hydroelectric licensing applicants identify and access existing information from past licensing proceedings that may be of value in ongoing and future proceedings. Access to this information can reduce the number and cost of studies, and can better focus needed studies to address site-specific considerations. The product described in this Technical Memorandum is focused on the effects of flow and water level fluctuations on environmental resources in impoundments and riverine areas. Another objective is to gain feedback on additional issues and types of information for inclusion in the spreadsheet tool that would provide the greatest benefit to members of the EPRI Waterpower Program.

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METHODS

The spreadsheet tool was created by initially identifying all final National Environmental Policy Act (NEPA) documents (both environmental assessments and environmental impact statements) issued since January 1, 2000, which were associated with hydroelectric licensing proceedings. We identified NEPA documents by reviewing the list of current licenses available on the FERC website to determine the date that each license was issued, reviewing licenses to determine the issuance date of the NEPA document supporting the license order, and then reviewing the NEPA document. In addition, we reviewed the list of pending licenses available on FERC's website to identify projects where NEPA documents had been issued but for which a license order was still pending.

For each project addressed in one of these NEPA documents, we entered information that may be useful for filtering the spreadsheet tool in different columns in the spreadsheet. These columns include: project name and FERC number, associated state and waterway, authorized capacity, and accession numbers[1] for the license order and NEPA document. We reviewed each project's final NEPA document for analysis and citations relating to the effects of water level and flow fluctuation on impoundment and riverine environmental resources. Any affected resources were listed in respective columns along with the referenced studies. A complete list of literature citations, including more than 500 sources and associated accession numbers is provided on the second tab of the spreadsheet tool.

[1] The accession number is a 12 digit number starting with the year, month, and date of filing. Any publicly available document filed on eLibrary can be easily accessed from eLibrary from the eLibrary advanced search page (http://elibrary.ferc.gov/idmws/search/fercadvsearch.asp).

3
RESULTS

The filterable spreadsheet tool includes hyperlinks and accession numbers for 281 NEPA documents that were issued to support licensing decisions on 356 hydroelectric projects, some of which address multiple hydroelectric projects or the multiple hydroelectric developments that may be included within a single license. We identified substantive analyses of the effects of flow and water level fluctuations on environmental resources in impoundments associated with 70 FERC projects, and analyses of effects on riverine resources associated with 117 FERC projects, and compiled a listing of 524 full citations of the reports cited in these analyses. The spreadsheet can be easily filtered to identify other licensing proceedings that have addressed a similar issue of concern, and most of these citations can be easily accessed from eLibrary by searching for the title of the citation.

Version 1.0 of the FERC Record Research Tool is available for download on the EPRI Waterpower Program CockPit at https://membercenter.epri.com/programs/014874/Pages/default.aspx.

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TIPS ON USING THE FERC RECORD RESEARCH TOOL

This section provides screenshots that show the layout of the spreadsheet tool and describe how to use the filters to identify information relevant to a user's need, as well as some tips on how to access the information from eLibrary.

Figure 4-1 (below) shows the first eight columns of the spreadsheet, which provide the FERC project number and name, the state(s) and waterway where the project is located, authorized capacity, accession number for the FERC license and the NEPA document that supported the license order, and the FERC project numbers of any other projects that were addressed in the NEPA document. The drop down arrow in the header of each column can be used to select groups of projects that share the same entry in that column or to conduct keyword searches to find all rows that contain the keyword. Each of the accession numbers given in columns F and G are hyperlinked to the document in eLibrary. Alternatively, the document can be accessed from eLibrary using the accession number in the eLibrary advanced search page at http://elibrary.ferc.gov/idmws/search/fercadvsearch.asp.

A	B	C	D	E	F	G	H
FERC Project No.	Project Name	State	Waterway	Authorized Capacity (MW)	License Order eLibrary Accession No.	NEPA Document eLibrary Accession No.	Projects Addressed in NEPA Document (if multiple)
6418	A.J. ALLEN	CO	EAST BRUSH CREEK	0.01	20030102-3081	20021025-3053	
2364	ABENAKI	ME	KENNEBEC RIVER	18.80	20030729-3001	20020919-3092	2364, 2365
12690	ADMIRALITY INLET TIDAL ENERGY	WA	PUGET SOUND	0.60	20140320-3041	20130809-3010	
1979	ALEXANDER	WI	WISCONSIN RIVER	4.20	20050304-3016	20041028-3036	
13124	ALLISON LAKE	AK	ALLISON LAKE	6.50	20130801-3017	20130621-3003	
11730	ALVERNO	MI	BLACK RIVER	1.10	20011205-0276	20010814-3026	
400	AMES	CO	SAN MIGUEL RIVER	3.50	20100519-3025	20091022-3016	
13417	ANGELO DAM	WI	LA CROSSE RIVER	0.21	20121228-3013	20120822-3027	
2699	ANGELS	CA	ANGELS CREEK	1.40	20030903-3012	20021025-3058	2699, 2019, 11563
2365	ANSON	ME	KENNEBEC RIVER	9.00	20030807-0326	20020919-3092	2364, 2365

Figure 4-1
Example of project input (columns A through H)

Figure 4-2 (below) shows some examples of the information that is provided in columns I and J relative to the issues addressed in the NEPA document for several FERC projects. These entries were selected to illustrate typical input, including some that did not include analysis of flow or water level fluctuations, others that provided analysis of some issues but did not include citations, and others where relevant citations were identified. We characterized issues or resources addressed using consistent terminology as much as possible to facilitate the use of keyword searches to locate information of interest.

I	J
Resources/Issues Analyzed in NEPA Document Effects of Water Level Fluctuation on Impoundment Resources (supporting reports cited provided in parentheses)	**Resources/Issues Analyzed in NEPA Document Effects of Flow and Water Level Fluctuations on Riverine Resources (supporting reports cited provided in parentheses)**
NA - ROR operation	NA - ROR operation
NA - Hydrokinetic project	NA - Hydrokinetic project
Limited analysis/citations	Recreational use (PSCO 2008) Ice processes (Ferrick and Murphy 2000; PSCO 2009) Riparian vegetation (Friedman et al. 2006) Brown trout (Uppendahl 2008) Minimum flows using R2CROSS method (CWCB 1996; PSCO 2007a)
Erosion (AESI 2003) Amphibian breeding habitat, egg masses (Hamer Environmental and R2 2003; Richter 1995) Snags/nesting habitat (no citations) Loons (no citations) Invasive plants (no citations) Cultural resources (no citations)	Salmon redds/egg incubation (Bauersfeld 1978, Chapman et al. 1986; Connor and Pflug 2004, Reiser and White 1983; Stuber et al. 1982) Rainbow trout (Everest and Chapman, 1972; Fausch 1984; Jenkins 1969; Pert and Erman 1994) Chinook migration (McPhee and Brusven 1976) Salmon stranding (Beck and Associates 1989) Invertebrates (Gislason 1985) Benthic fauna (Brusven 1984; Trotzky and Gregory 1974) Wild and scenic designation (no citations)

Figure 4-2
Example of issues and citations (columns I and J)

Figure 4-3 shows an example of the dropdown menu that appears when you click the arrow in a header column. In the example below, we used the text filter to search for all rows that include the words "ramping rate" in that column. Alternatively, you can select or exclude all rows that have a specific entry by checking or unchecking the boxes adjacent to each entry shown in the dropdown menu, or sort all rows alphabetically using the sort functions at the top of the menu. Partial results of a keyword search for "ramping rate" in column J are shown in Figure 4-4.

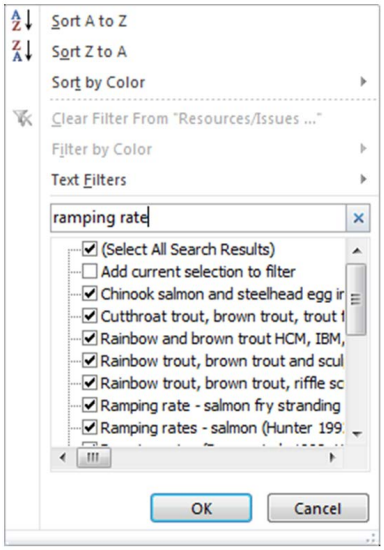

Figure 4-3
Conducting a keyword search

Resources/Issues Analyzed in NEPA Document Effects of Water Level Fluctuation on Impoundment Resources (supporting reports cited provided in parentheses)	Resources/Issues Analyzed in NEPA Document Effects of Flow and Water Level Fluctuations on Riverine Resources (supporting reports cited provided in parentheses)
Limited analysis/citations	Rainbow trout, brown trout and sculpin (Tri-Dam 2002) Foothills yellow-legged frog (Tri-dam 2003) Ramping rates (Hunter 1992)
Limited analysis/citations	Ramping rates and fish stranding (Bradford et al. 1995; Brusven et al. 1974; Gislason 1980; Hunter 1992; Kroger 1973) Salmoid egg dewatering risk (Reiser and White 1983)
Limited analysis/citations	Ramping rates - salmon (Hunter 1992)
Wetlands (DTA 2004a)	Ramping rates and fish stranding (CDFG 2007) Wetlands (DTA 2004a) Foothills yellow-legged frog (CDFG 2007; DTA and Stillwater 2004a; Kupferberg 2006; Mount et al. 2006) Recreation - boating (DTA and Louis Berger 2004)
Crappie spawning (APC 2005) Wetlands (no citations)	Ramping rates (no citations)
Limited analysis/citations	Ramping rates (Hunter 1992)
Limited analysis/citations	Chinook salmon and steelhead egg incubation (BioAnalysts 2002, 2003) Minimum flows for cutthroat trout and catostomids (R2 and IA 2000) Ramping rates (Hunter 1992)
Archaeological site erosion (PG&E 2009b)	Rainbow and brown trout HCM, IBM, IFIM, and PHABSIM studies (PG&E 2009a) Fish and macroinvertebrate stranding due to ramping rates (Bradford et al. 1995; Hunter 1992; Huntington 2004) Recreation - fishing and whitewater boating (PG&E 2009a)
Limited analysis/citations	Ramping rates (FS 2001; Hunter 1992; Stillwater Sciences, Inc. 1998)

Figure 4-4
Example of results of a keyword search in column J

Figure 4-5 shows the first few entries in the listing of supporting studies and reports provided in the second tab of the spreadsheet. The second column provides the accession number(s) of the NEPA documents from which they were cited. Most of these citations are available on eLibrary and can be found by entering part or all of the title in the text search box on eLibrary, either on the General Search (http://www.ferc.gov/docs-filing/elibrary.asp) or Advanced Search (http://elibrary.ferc.gov/idmws/search/fercadvsearch.asp) page.

Supporting Studies and Reports

Citation	Cited From:
Aadland, L. P., C. M. Cook, M. T. Negus, H. G. Drews, and C. S. Anderson. 1991. Microhabitat preferences of selected stream fishes and a community-oriented approach to instream flow assessments. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Section of Fisheries. Investigational Report No. 406.	2000229-0720
Addley, C., J. Ludlow, B. Bradford, L. Basdekas, M. Winkelaar, and T. Hardy. 2003. Lower Oak Grove Fork two-dimensional habitat modeling. Prepared Portland General Electric and U.S. Forest Service.	20061221-4000
Addley, R. C., B. Bradford and J. Ludlow. 2005. Klamath River Bioenergetics. Report Prepared for PacifiCorp. Institute for Natural Systems Engineering, Utah Water Research Lab, Utah State University, Logan, Utah.	20071116-4001
AESI (Associated Earth Sciences, Inc.). 2003. Baker River Hydroelectric Project, reservoir shoreline erosion and deposition Study A-14a, Skagit and Whatcom Counties, Washington. Prepared for Puget Sound Energy, Inc. Kirkland, Washington. March 31, 2003.	20060908-4000
Aho, J. M., C. S. Anderson, and J. W. Terrell. 1986. Habitat suitability index models and instream flow suitability curves: redbreast sunfish. U.S. Fish and Wildlife Service Biological Report 82(10.119).	2000229-0720
Allen, A. W. 1983. Habitat suitability index models: Beaver. U.S. Fish Wildlife Service FWS/OBS-82/10.30 Revised 20pp.	200110914-3025
Allen, A. W., and R. D. Hoffman. 1984. Habitat suitability index models: Muskrat. U.S. Fish Wildlife Service FWS/OBS-82/10.46 27pp.	200110914-3025
Andrews, E. D. and J. M. Nankervis. 1995. Effective discharge and the design of channel maintenance flow for gravel-bed rivers. *In*: Natural and anthropogenic Influences in fluvial morphology. J.E. Costa, A.J. Miller, K.W. Potter, and P. R. Wilcock (eds.). American Geophysical Union, Geophysical Monograph 89.	20060427-3060
Aney, W. W., M. L. Montgomery, and A. B. Lichens. 1967. Lower Deschutes River Oregon: discharge and the fish environment. Lower Deschutes flow study final report. Oregon Game Commission, Portland, Oregon.	20040607-0041
Anglin, D. R., S. L. Haeseker, J. J. Skalicky, H. Schaller, K. F. Tiffin, J. R. Hatten, D. W. Rondorf, P. Hoffarth, J. Nugent, D. Benner, and M. Yoshinaka. 2005. Effects of hydropower operations on spawning habitat, rearing habitat, and stranding/entrapment mortality of fall Chinook salmon in the Hanford Reach of the Columbia River. Draft Report dated April 12, 2005.	20061117-4002
Anglin, D. R., S. L. Haeseker, J. J. Skalicky, H. Schaller, K. F. Tiffin, J. R. Hatten, P. Hoffarth, J. Nugent, D. Benner, and M. Yoshinaka. 2006. Effects of hydropower operations on spawning habitat, rearing habitat, and stranding/entrapment mortality of fall Chinook salmon in the Hanford Reach of the Columbia River. Final Report dated August 10, 2006.	20061117-4002
Annear et al. 2002. Instream flows for riverine resource stewardship. Instream Flow Council. 410 pp.	20070329-3045
Annear, T. C. and A. L. Conder. 1984. Relative bias of several fisheries instream flow methods. North American Journal of Fisheries Management 4:531-539.	20060427-3060

Figure 4-5
Example listings on the supporting studies and reports tab of the spreadsheet tool

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POTENTIAL NEXT STEPS

Version 1.0 of the FERC Record Research Tool was developed to provide member utilities with a way to access information relative to the effects of flow and water level fluctuations; however, it also serves also as a proof of concept to test and demonstrate methods to facilitate locating information on eLibrary. There is a wide range of information available on other issues for those facing the FERC licensing process, and the spreadsheet tool could easily be expanded to include additional issues and types of information.

We have identified several topics for potential expansion of the spreadsheet tool that would help to address issues that are common to many hydroelectric licensing proceedings. If funding is available, we recommend that the following topics be incorporated into version 2.0.

1. *Desktop Analyses of Fish Entrainment*—The issue of fish entrainment is frequently addressed by conducting desktop analysis of fish entrainment and turbine mortality using information collected in field studies from other sites, frequently using information that was compiled in the entrainment database by EPRI in 1997 (Project TR-108630). These analyses provide valuable templates for this type of analysis, as well as summaries of useful information on fish swimming speeds, other factors that may influence entrainment rates (e.g., habitat preferences relative to the location of an intake) and turbine mortality rates for different classes of turbines. Adding a page to the FERC Record Research Tool spreadsheet that provides the accession numbers for desktop analyses of fish entrainment filed within the last 10 to 20 years would provide ready access to these analyses and simplify addressing this issue.
2. *Turbine Mortality Studies*—While many of the desktop analyses of fish entrainment include tabulated information on the survival/mortality rate of fish passing through turbines that are relevant to a specific project, it would be useful to have the information on turbine mortality rates applicable to a wide range of turbine types and characteristics available in a single spreadsheet. While, the 1997 EPRI database includes the results of many studies conducted prior to 1997, a large number of studies have been conducted since that time. Many of these more recent studies have used improved techniques and provide more accurate estimates than some of the earlier studies, where a high level of stress, injury, and mortality occurred in cases where nets were used to collect fish from the tailrace after they passed through the turbines. Compiling available turbine mortality estimates that were collected using more accurate methods would be an addition to the spreadsheet tool that would allow FERC applicants to select the data that is most applicable to their project to estimate likely rates of turbine mortality. This would be valuable to all hydroelectric project owners, because turbine mortality is a nearly universal issue during the licensing process.
3. *Invasive Species Management*—Management of invasive species is also an issue in nearly every FERC licensing proceeding. Most licenses include provision for invasive species management, especially for invasive plants that may colonize areas that are disturbed during construction activities. Adding a page to the spreadsheet tool that would allow the user to identify and access recent invasive species management plans developed

for other projects would allow the user to consider the types of mitigation measures being employed at other projects, and would facilitate the development of plans that include best practices employed at other projects.

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