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APROPOS—the aquatic plant management strategy planner

by

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The aquatic plant manager is faced with a daunting task that demands knowledge and skills of a wide range. Extensive technical, operational, economic, sociological, and regulatory data are required. In addition, the aquatic plant manager must exercise skill in managing contacts with diverse



Developing a management plan for all components of an aquatic community—exotic plants, native plants, and fish—is the challenge

government agencies and interest groups and in balancing the operational budget. The decision-making process is further complicated by the need for site-specific rather than whole-lake management.

Almost 30 years of research and development within the U.S. Army Corps of Engineers—combined with active research and development by other federal and state agencies, universities, and commercial enterprises—has produced a vast body of largely unintegrated information that is now available to the manager. An integrated, systematic method of retrieving this information is needed.

A number of developments have been made in personal computer software and hardware. These make it feasible to develop a systematic method of information access and retrieval that can be used by the majority of Corps plant managers as an aquatic plant management strategy planning tool. The Aquatic Plant Resource Operations & Planning Online Sup-

port (APROPOS) system is built on this expanding technology.

APROPOS is a computer-assisted tool to help aquatic plant managers integrate all the information available for developing management plans.

APROPOS includes a graphics user interface shell that accesses modules to perform a number of tasks. These include developing systematic aquatic plant management plans, retrieving necessary information, operating computer simulations, using databases, and interfacing with geographic information systems (GIS). It is anticipated that, during its development, APROPOS will help the developers pinpoint areas for further research.

The main menu of APROPOS will allow the user to access the planner, as well as the literature databases, simulation tools, field techniques toolbox, controls technique toolbox, database menu, and the Help menu, as typically found in Windows programs (Table 1).

The APROPOS system will be modular, to allow upgrading of information and tools, to allow components to be used as stand-alone packages as desired, and to ensure that components can be



incorporated into the system as they become operational.

The following sections describe the APROPOS modules that are planned for development.

Planner

The planner section contains the tools necessary to create an

operational, site-specific management plan (Figure 1). The components require that this process begin with identifying the problems of a given site, the interest groups that may be involved, management goals, and potential solutions to achieve the management goals.

Since planning is spatially oriented and site-specific, a sketch-

pad for non-GIS users is included in this section. The sketchpad can create rough diagrams of the management site that contain features relevant to management planning.

Additional tools will help the user develop a planning and operational timeline, maintain a record of contacts with interest groups, identify financial and human resources available to the operational plan, and verify the effectiveness of the plan.

A print function allows the user to print out the plan components. The format used for plans will be consistent, to facilitate information exchange between sites. The APROPOS planner will also include a section that evaluates the success of the plan after implementation. These reports will also be in a standardized format to ease data compilation and exchange.

Literature database

The literature database will comprise key reference materials, including those used in the development of other toolboxes (Figure 2). Some citations will include abstracts or entire sections of text for further study. The sources of these references include scientific and technical reports and publications, operational information, regulatory guides and statutes, herbicide labels, and environmental information.

Since it is not possible to include all of the available literature on aquatic plant management, contacts for other sources of information will be included (for example, the Aquatic Plant Information Retrieval System developed by the Center for Aquatic Plants).

Main Menu	Components	Purpose
Planner	<ul style="list-style-type: none"> • Situation • Report • Sketchpad 	<ul style="list-style-type: none"> • Builds, modifies, prints and evaluates plans
Literature database	<ul style="list-style-type: none"> • Bibliographic database • Modem access to other sources • Information on supplementary databases • Directory of personnel 	<ul style="list-style-type: none"> • Searches for key information sources, direction to additional help, access to some reports and abstracts
Simulation toolbox	<ul style="list-style-type: none"> • Plant growth • Control techniques • Environmental effects • Economic 	<ul style="list-style-type: none"> • Allows examination of potential impacts of selected actions
Field techniques toolbox	<ul style="list-style-type: none"> • Hypertext manuals • Expert systems • Plant identification guide 	<ul style="list-style-type: none"> • Presents guides on developing sampling plans and carrying out data collection
Control techniques toolbox	<ul style="list-style-type: none"> • Biological control • Chemical control • Mechanical control • Physical control • Alternative controls 	<ul style="list-style-type: none"> • Accesses critical information on each control technique and its alternatives
Database toolbox	<ul style="list-style-type: none"> • Case studies • GIS access (ArcView) • Other databases, database management tools • Straightforward statistical analysis 	<ul style="list-style-type: none"> • Reviews how other managers have approached similar situations • Accesses database
Help function	<ul style="list-style-type: none"> • Context-sensitive hypertext tutorial 	<ul style="list-style-type: none"> • Assists user in operation of program

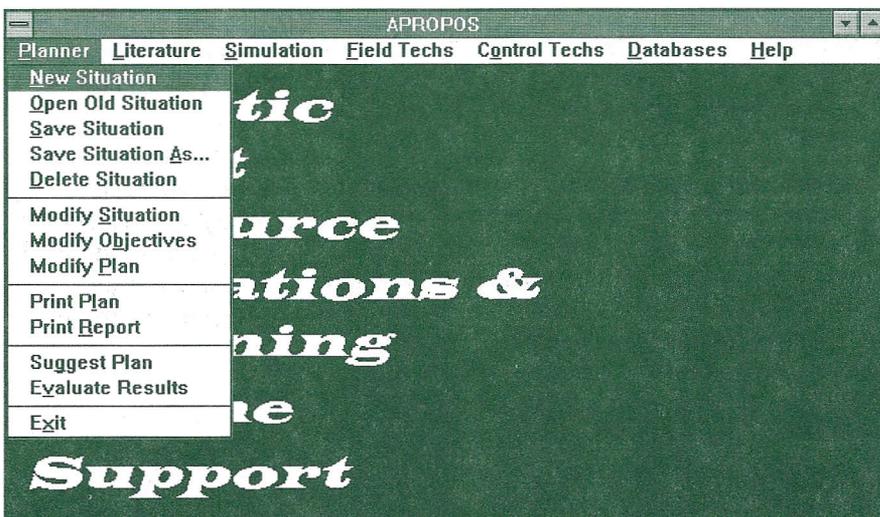


Figure 1. Planner submenu for APROPOS

APROPOS will also include an indexed database of Waterways Experiment Station (WES) scientists, other experts, and local and regional points of contact. This will enhance access to the best source of information: other people.

Simulation toolbox

The simulation toolbox will provide access to simple models to project the potential results of different management alternatives. The submenus will include plant growth models, control technique simulations, environmental simulations, and economic simulations (Figure 3). Models will include those produced by the Aquatic Plant Simulation Team at WES, other WES teams, researchers outside WES, and potential future collaborators.

Plant growth models will serve as the basis for control technique evaluations. Specific growth models for waterhyacinth, Eurasian watermilfoil, and hydrilla are currently being developed. These would include generalized models of native plant growth and community models that examine the effect of plant competition and succession.

Control technique models will include simulations of biological control agents as well as chemical, mechanical, and physical control techniques. In this area, the WES Simulation Team has already converted AMUR STOCK (a biological control model of grass carp feeding) and HERBICIDE (a herbicide dissipation model) into Windows format for direct inclusion in APROPOS. Other models, including INSECT (insect biocontrols for waterhyacinth) and HARVEST (harvester simulations), will be converted to a Windows-compatible format as time permits.

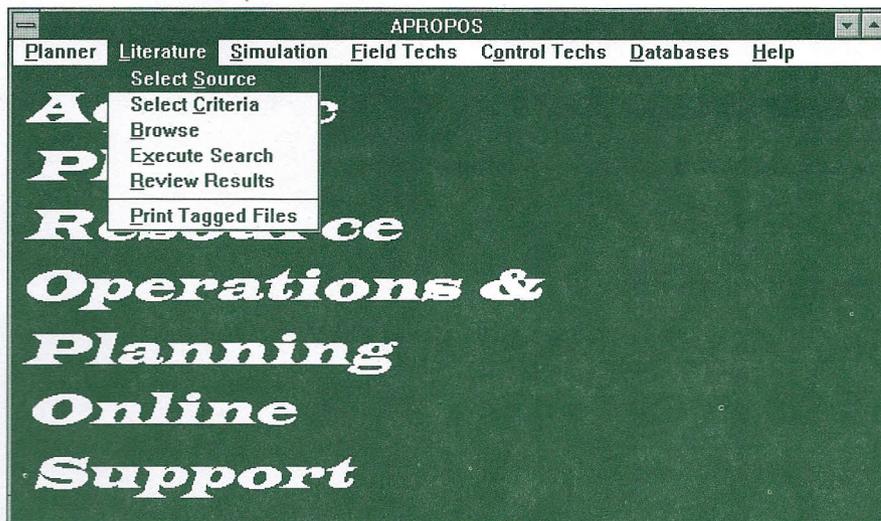


Figure 2. Literature database submenu for APROPOS

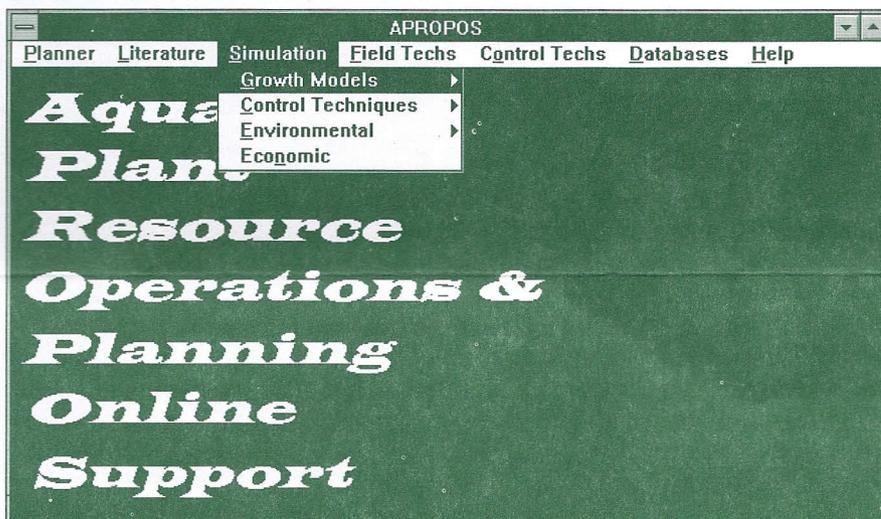


Figure 3. Simulation toolbox submenu for APROPOS



A plant growth model for waterhyacinth will be included in the APROPOS system

Environmental models will include simulations of the effects of management on fish communities, water quality, and other functions. Tools for evaluating ecological risk are another possible feature for development.

Economic models, such as those developed by WES for Gunterville Reservoir, will assist in evaluating the possible financial impacts of various management strategies. Cost projections and cost-benefit analyses are necessary for ongoing aquatic plant management programs in the current fiscal climate.

The majority of the models described above are not currently available for inclusion in the APROPOS system. However, assuming continued support for development of APROPOS under the Aquatic Plant Control Research Program (APCRP), these planned additions will be accomplished as models are completed, whether under APCRP, collaborating research programs, or other institutions. Because APROPOS is modular, the inclusion of a diversity of simulation models can be easily accomplished.



Plant quantification techniques, such as diver observations, will be included in the APROPOS field techniques toolbox

Field techniques toolbox

The field techniques toolbox will help the manager to develop a sampling program for evaluating the plan objectives, at a minimal cost (Figure 4).

This toolbox will provide managers with a working knowledge of various monitoring techniques, so that they can collect the data them-

selves or oversee the efforts of others. Fundamental to this effort is identifying target and native plant species through a plant identification "expert system," which is included in the field techniques toolbox.

Quantitative methods for discrete population sampling include cover estimation, transect, and biomass techniques. For larger scale evaluations, GPS (global positioning system), bathymetric, and remote sensing techniques will be presented. Other sampling techniques, such as evaluating water movement and herbicide dissipation, will also be explained. Data entry, analysis, and evaluation can be performed within the database menu. Since identical database structures will be used, data can be shared between different users.

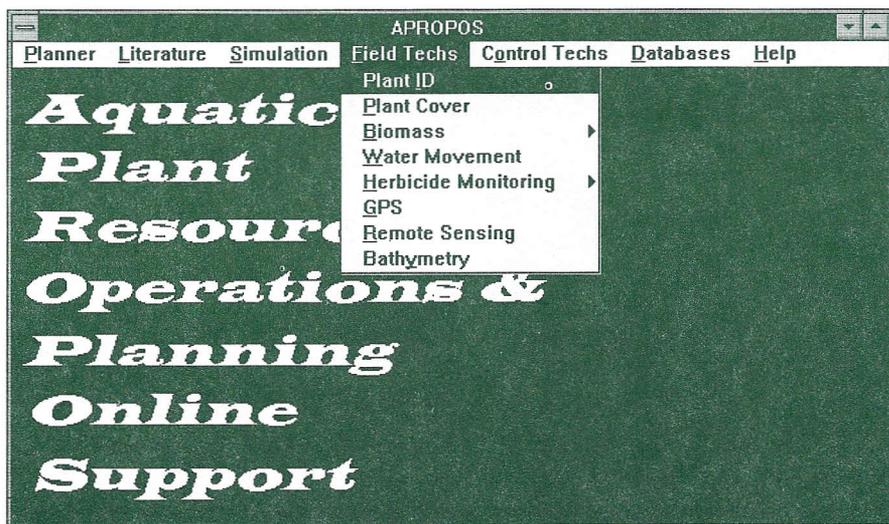


Figure 4. Field techniques toolbox submenu for APROPOS

Control techniques toolbox

The control techniques toolbox will access information needed for selecting among various management techniques, based on economic, environmental, and efficacy concerns. This toolbox will include information on biological, chemical, mechanical, and physical control techniques, as well as less traditional control techniques (Figure 5).

Key information on various biological control options, including

the expert system developed by the WES Biological Control Team, will be presented in summary tables. Biological control agents to be considered include insects, pathogens, fish, and other generalist herbivores. Overview information will also include a survey of agents that have been investigated in the past, and others currently under development.

Chemical control information will be summarized, including pertinent U.S. Environmental Protection Agency label information and Federal and state regulations.

Federal, state, and regional regulatory points of contact will also be provided for access to up-to-date information.

Mechanical and physical control techniques will be evaluated in terms of efficacy, cost, and potential impacts. Alternatives to standard control methods (such as quarantine, zoning, access restriction, and regulatory procedures) will be described. These alternative methods may help managers develop a holistic management plan.

Databases

Four independent submenus will comprise the "Databases" menu: case studies, GIS, other databases, and data analysis (Figure 6). These four semi-independent components interact to form a powerful tool to view past, present, and future data.

Case studies will report both successes and failures in aquatic plant management, as well as insight into the causes of these outcomes. Ideally, the manager will be able to see how others approached a similar situation, and their results. As more individuals use the APROPOS report functions, an expanding database will allow managers to get an overview of how aquatic plants are being managed nationwide.

The GIS interface initially will allow those with ArcView and an existing GIS to interactively explore their data, while within APROPOS, and transfer data from the GIS to the planning modules. Eventually, a more direct link to ArcInfo will be made, to allow two-directional flow of data and viewing of simulation results.

Other databases will be accessible through the database menu. The most important of these is the site-specific information collected and entered by the manager.

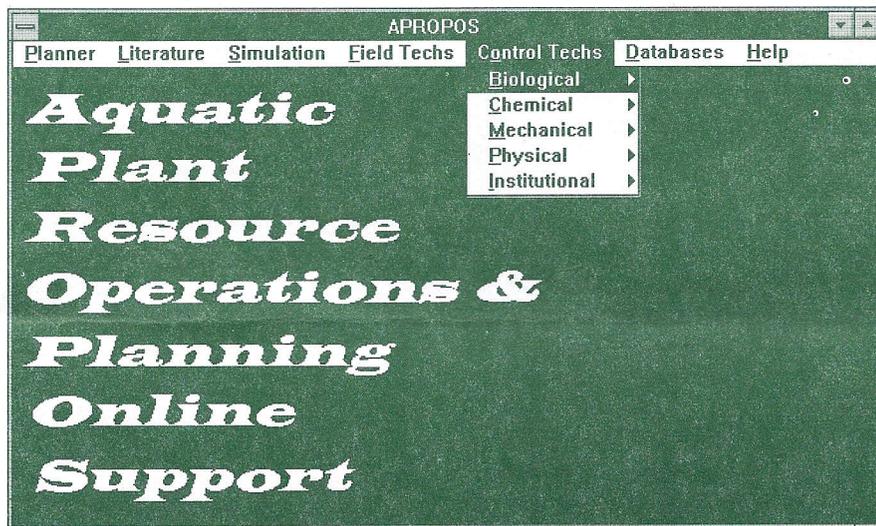
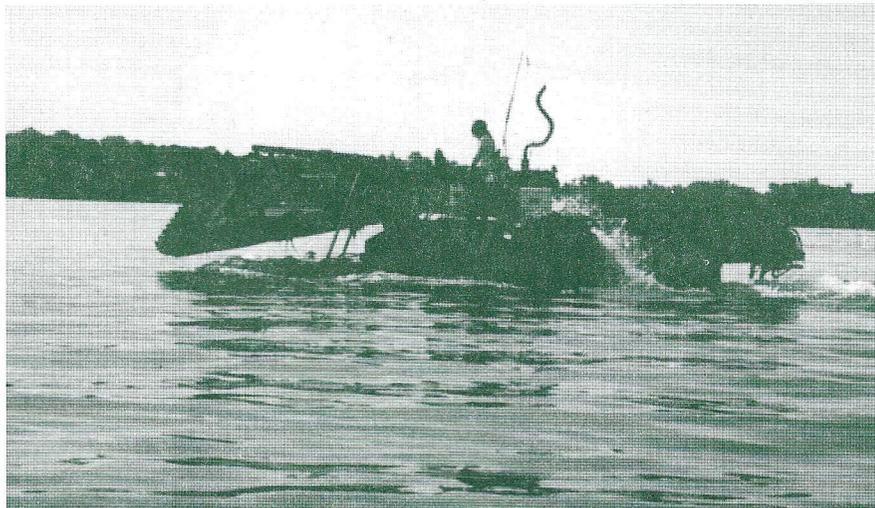


Figure 5. Control techniques toolbox submenu for APROPOS



Information required for using harvesters will be included in the control techniques toolbox

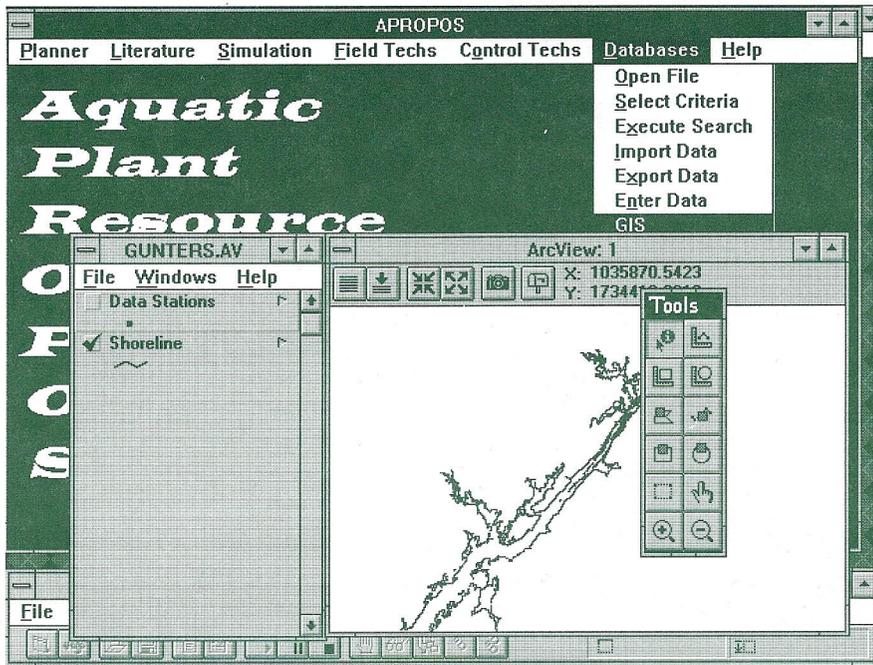


Figure 6. Database submenu for APROPOS



Other databases, such as light availability, will be available for APROPOS to operate simulation models

Since the format will be standardized, these data can be easily exchanged and used for case studies by other APROPOS users. Databases generated for simulation model initializations will also be available from the Center for Aquatic Plant Research and Technology at WES.

A simplified data analysis program will allow statistical analysis and graphical presentation of data from different sources, such as data collected by the manager, from case studies, and simulation output visualization. The graphical presentation tool is being developed by the WES Simulation Team. Software routines to link APROPOS to popular software programs are also being considered.

Help section

A context-sensitive Help function will assist the user in navigating APROPOS. For information on related topics, the user will click on highlighted text ("hypertext") to access the additional information. These functions will allow users to use the program without reading a manual or knowing a given command. Hypertext manuals will also be used throughout the toolboxes and menus to allow the user to rapidly access and cross-reference needed information.

What does the future hold?

As computer technology expands and becomes less expensive, APROPOS menus will be able to provide graphics, animation, video, and sound. CD-ROM versions of APROPOS will make use of extensive compilations of data, video, and other memory-intensive applications.

Strengths of APROPOS

APROPOS will be readily upgradable, because of its modular design. Many components will be usable as stand-alone features even before the entire system is completed. Its flexibility, expandability, and growth potential are almost limitless. In addition, the user-friendly interface (Windows) will make it an approachable technology transfer tool.

APROPOS needs you!

To be a success, APROPOS needs input from WES researchers, field personnel, state cooperators, and other interested individuals. As the tools are being developed, the assistance of WES technology teams will be sought for development, review, and updates on key components. Feedback from the Field Review Group and potential users will also

be solicited through workshops and beta/alpha evaluation releases of the system.

Anyone interested in commenting on the APROPOS system can do so by contacting John Madsen (madsenj@ex1.wes.army.mil, (214) 436-2215) or the Assistant Director of the CAPRT, Bob Gunkel (gunkelr@ex1.wes.army.mil, (601) 634-3722).

Summary

APROPOS, the Aquatic Plant Resource Operations & Planning Online Support system, will allow aquatic plant managers to easily access information they need to develop a comprehensive aquatic plant management plan. The system provides a systematic planning framework and a consistent reporting format for interchangeable databases among multiple aquatic plant management projects.

The goal is to make aquatic plant management not only better, but easier.



Waterhyacinth information will be included in the aquatic plant identification guide

Dr. John D. Madsen, a research biologist in the Environmental Laboratory, U.S. Army Engineer Waterways Experiment Station (WES), is stationed at the Lewisville Aquatic Ecosystem Research Facility (LAERF). He leads the Aquatic Plant Simulation Team, and his expertise includes the phenology, ecology and management of aquatic plants. Dr. Madsen has a Bachelor of Science degree in Biology from Wheaton College and Master of Science and Doctor of Philosophy degrees in Botany from the University of Wisconsin-Madison.



Mr. Joseph K. McAllister, Jr., is a member of the technical staff of Teleconsult, on contract to WES. Mr. McAllister's expertise is in programming and software development. He holds a Bachelor of Science degree in Computer Science and Physics from Millsaps College and is a candidate for a Master's degree in Computer Science from Mississippi State University. He currently serves as the Web Administrator for WES.





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In this issue, plans for the development of a systematic and integrated aquatic plant management strategy planning tool are presented. The Aquatic Plant Resource Operations & Planning Online Support (APROPOS) system will allow the manager to have access to key information and computer tools to develop comprehensive site-specific management plans.



Aquatic Plant Control Research Program

This bulletin is published in accordance with AR 25-30 as one of the information dissemination functions of the Environmental Laboratory of the U.S. Army Engineer Waterways Experiment Station. It is principally intended to be a forum whereby information pertaining to and resulting from the Corps of Engineers' nationwide Aquatic Plant Control Research Program (APCRP) can be rapidly and widely disseminated to Corps District and Division offices and other Federal and State agencies, universities, research institutes, corporations, and individuals. Contributions are solicited, but should be relevant to the management of aquatic plants, providing tools and techniques for the control of problem aquatic plant infestations in the Nation's waterways. These management methods must be effective, economical, and environmentally compatible. The contents of this bulletin are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such products. This bulletin will be issued on an irregular basis as dictated by the quantity and importance of information to be disseminated. Communications are welcomed and should be addressed to the Environmental Laboratory, ATTN: John W. Barko, U.S. Army Engineer Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, or call (601) 634-3654.

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