Oil & Natural Gas Technology

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Final Technical Report

Online Produced Water Treatment Catalog and Decision Tool

Submitted by:
ALL Consulting, LLC
1718 S. Cheyenne Ave.
Tulsa, OK, 74119

Principal Author: J. Daniel Arthur, P.E., SPEC

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Final Technical Report

TITLE: **Online Produced Water Treatment Catalog and Decision Tool**

Recipient: Arthur, Langhus, Layne- LLC, /dba ALL Consulting, LLC
1718 S. Cheyenne Ave.
Tulsa, OK 74119

Principal Investigator: J. Daniel Arthur, P.E., SPEC
Darthur@all-llc.com, 918-382-7581

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Period: October 1, 2008 – March 31, 2012

Executive Summary

The objective of this project was to create an internet-based Water Treatment Technology Catalog and Decision Tool that will increase production, decrease costs and enhance environmental protection. This is to be accomplished by pairing an operator's water treatment cost and capacity needs to specific water treatments.

This project cataloged existing and emerging produced water treatment technologies and allows operators to identify the most cost-effective approaches for managing their produced water. The tool captures the cost and capabilities of each technology and the disposal and beneficial use options for each region. The tool then takes location, chemical composition, and volumetric data for the operator's water and identifies the most cost effective treatment options for that water. Regulatory requirements or limitations for each location are also addressed. The Produced Water Treatment Catalog and Decision Tool efficiently matches industry decision makers in unconventional natural gas basins with: 1) appropriate and applicable water treatment technologies for their project, 2) relevant information on regulatory and legal issues that may impact the success of their project, and 3) potential beneficial use demands specific to their project area.

To ensure the success of this project, it was segmented into seven tasks conducted in three phases over a three year period. The tasks were overseen by a Project Advisory Council (PAC) made up of stakeholders including state and federal agency representatives and industry representatives. ALL Consulting has made the catalog and decision tool available on the Internet for the final year of the project.

The second quarter of the second budget period, work was halted based on the February 18, 2011 budget availability; however previous project deliverables were submitted on time and the deliverables for Task 6 and 7 were completed ahead of schedule. Thus the application and catalog were deployed to the public Internet. NETL did not provide additional funds and work on the project stopped on February 18, 2011. NETL ended the project on March 31, 2012.

Results of Work During the Reporting Period

Approach

Task 1: Project Management Plan and Technology Status Assessment

Under this task, ALL Consulting completed and submitted the Project Management Plan (PMP) and the Technology Status Assessment (TSA) for this project. The PMP was submitted on October 6, 2008, and the TSA on November 13, 2008. The TSA was revised to incorporate NETL comments on December 9, 2008. Other project management activities planned for this task were also completed. All work was completed according to schedule.

Task 2: Research Water Treatment Technologies

ALL Consulting continues to collect data on water treatment technologies. ALL is reviewing previous NETL reports and other available literature prior to arranging site visits to get more detailed information on the various technologies. One site visit with Fountain Quail was completed and a tele-conference was held with Ecosphere. All work is progressing according to schedule.

Task 3: Research Regulatory and Legal Issues

ALL Consulting's partner for this project, the Ground Water Protection Council (GWPC) has been assigned the lead role for gathering data on this task. GWPC is working through its members and through the Project Advisory Council (PAC) to identify data sources for this information. All work is progressing according to schedule.

Task 4: Research Water Demands in Unconventional Basins

ALL Consulting has completed an assessment of water needs in shale gas basins. This data will be used to assess the potential for beneficial uses in areas where produced water treatment is economic or where no treatment is required. Work on this task is proceeding according to schedule.

Task 5: Develop System Specifications

ALL Consulting has completed the development of system specifications.

Task 6: System Development

ALL Consulting has completed development of the system. ALL has developed logic flow charts for each of the decision pathways. The logic flow charts begin with identifying the shale gas basin and the regulatory jurisdiction in which the water will be generated. Once that selection is made, the user is asked to select a management option and is provided with a series of options to determine the applicable treatment options and the considerations that apply to each option.

Task 7: Implementation

ALL's public Internet server was configured and the application was tested and deployed. A use guide was produced and linked on the application's web download page. Additionally, system requirements and overview were scripted on the page to help the user in evaluation of their system to enable the application to be executed within their hardware set (computer/network).

Results

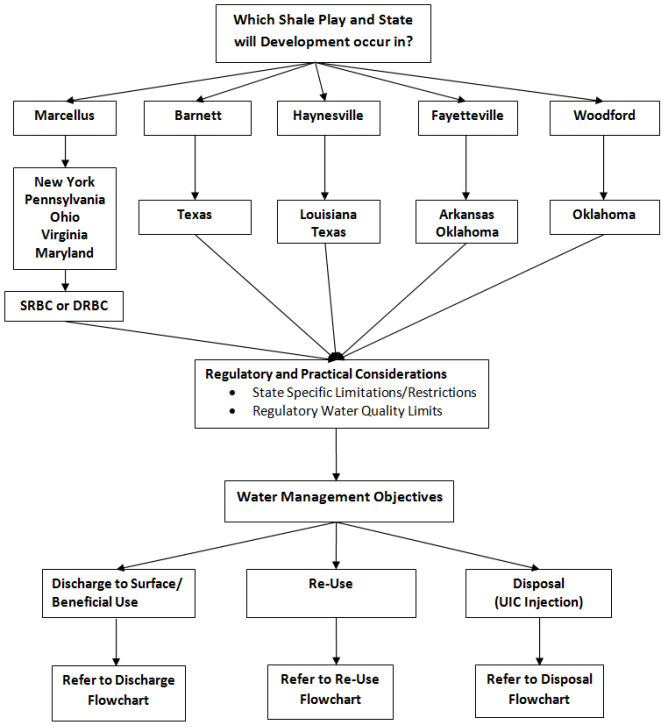
In developing the decision tool, the following flow-charts were developed to guide the decision processes being built into the system. The decision tool itself has numerous interactions between the various flow charts. However, the flow charts shown below provide an overall view of the logic-flow that is being used in the system. The application programming and server configura-

tion was completed as scheduled and the “Water Treatment Technology Decision Tool” and “Water Treatment Catalog” was deployed on the public internet through the project website.

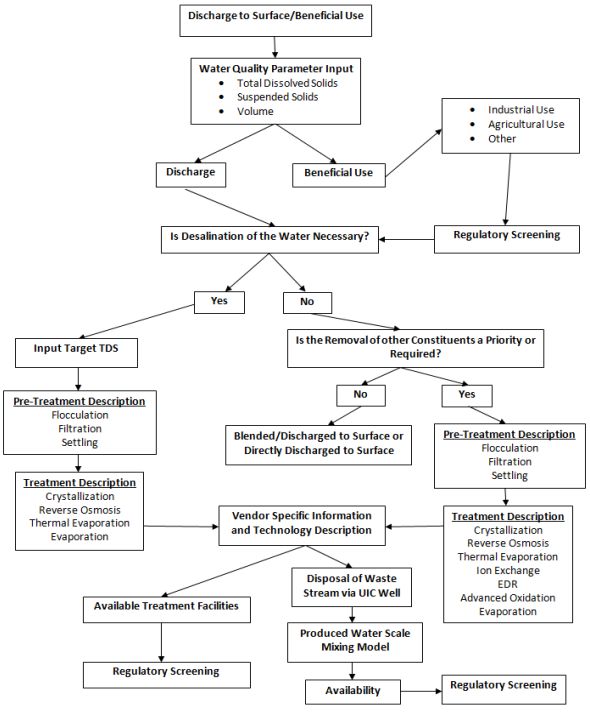
The PAC was notified of the availability of the Tool and Catalog and members were asked to review the site and provide comments. However, due to a funding shortfall, work on the project was stopped before any additional work on the site could be accomplished.

NETL did not provide additional funds and work on the project stopped on February 18, 2011. NETL ended the project on March 31, 2012.

Produced Water Catalog Decision Tool Flowchart: To Water Management Objectives

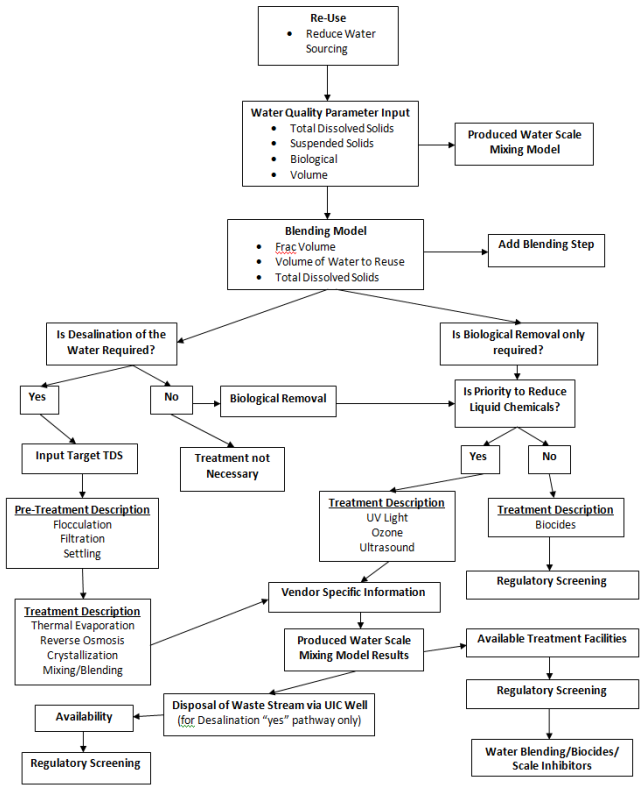


Produced Water Catalog Decision Tool Flowchart: Discharge or Beneficial Use



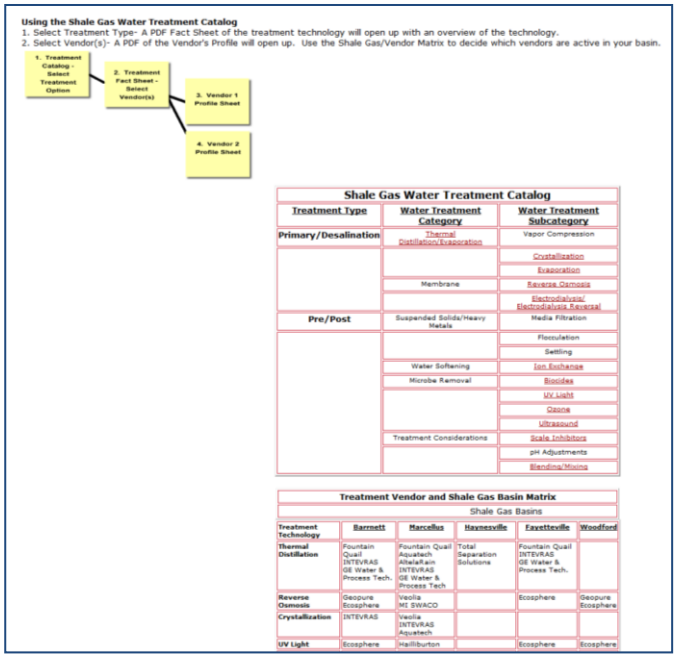
Produced Water Catalog Decision Tool Flowchart: Disposal

Produced Water Catalog Decision Tool Flowchart: Re-Use



The Screen Captures for the Water Treatment Catalog and Decision Tool

Water Treatment Catalog:



Using the Shale Gas Water Treatment Catalog

1. Select Treatment Type- A PDF Fact Sheet of the treatment technology will open up with an overview of the technology.
2. Select Vendor(s)- A PDF of the Vendor's Profile will open up. Use the Shale Gas/Vendor Matrix to decide which vendors are active in your basin.

1. Treatment Catalog - Select Treatment Option
2. Treatment Fact Sheet - Select Vendor(s)
3. Vendor 1 Profile Sheet
4. Vendor 2 Profile Sheet

Shale Gas Water Treatment Catalog

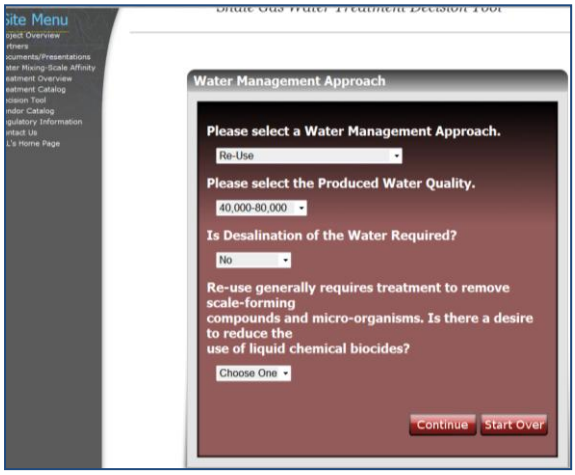
Treatment Type	Water Treatment Category	Water Treatment Subcategory
Primary/Desalination	Thermal Distillation/Evaporation	Vapor Compression
		Crystallization
		Evaporation
	Membrane	Reverse Osmosis
		Electrodialysis/ Electrodialysis Reversal
Pre/Post	Suspended Solids/Heavy Metals	Media Filtration
		Flocculation
		Settling
	Water Softening	Ion Exchange
	Microbe Removal	Biocides
		UV Light
		Ozone
		Ultrasound
	Treatment Considerations	Scale Inhibitors
		pH Adjustments
		Blending/Mixing

Treatment Vendor and Shale Gas Basin Matrix

Shale Gas Basins

Treatment Technology	Barnett	Marcellus	Haynesville	Fayetteville	Woodford
Thermal Distillation	Fountain Quail INTEVRAS GE Water & Process Tech.	Fountain Quail Aquatech AltelaRain INTEVRAS GE Water & Process Tech	Total Separation Solutions	Fountain Quail INTEVRAS GE Water & Process Tech.	
Reverse Osmosis	Geopure Ecosphere	Veolia MI SWACO		Ecosphere	Geopure Ecosphere
Crystallization	INTEVRAS	Veolia INTEVRAS Aquatech			
UV Light	Ecosphere	Halliburton		Ecosphere	Ecosphere

Decision Tool:



Conclusion

All activities in the second quarter of Budget Period 3 ended on February 18, 2011, when NETL did not provide the remainder of the funding for the Budget Period. NETL ended the project on March 31, 2012.

Milestone Status

Milestone 5, "Deployment to the public internet" was completed on 1/31/11 with the addition of the "Water Treatment Catalog" with vendors and the "Treatment Technology Decision Tool" added to the project website at http://www.all-llc.com/projects/produced_water_tool/index.php

Milestone Status Table

Budget Period	Milestone Description	Status	Planned Completion Date	Actual Completion Date
I	Completion of data collection of water treatment technologies and completion of data collection of regulatory and legal issues.	Completed	07/31/09	07/31/09
	Completion of data collection of water demands in unconventional basins	Completed	07/31/09	07/31/09
II	Complete interim document outlining the on-line system's specifications and features	Completed	12/31/09	12/15/09
III	Completion of application programming and server configuration	Completed	10/30/10	10/29/10
	Deployment to the public internet	Completed	1/31/11	1/31/11
	Technology transfer to various stakeholder groups through various venues and medial channels	Cancelled	09/30/11	

National Energy Technology Laboratory

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880

13131 Dairy Ashford, Suite 225
Sugarland, TX 77478

1450 Queen Avenue SW
Albany, OR 97321-2198

2175 University Ave. South
Suite 201
Fairbanks, AK 99709

Visit the NETL website at:
www.netl.doe.gov

Customer Service:
1-800-553-7681