



Technology Assessment Protocol – Ecology (TAPE)

Process Overview



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Water Quality Program
Washington State Department of Ecology
Olympia, Washington

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Introduction

This document provides an overview of the Technology Assessment Protocol-Ecology (TAPE) process for vendors, designers, and manufacturers (referred to as 'proponents') who wish to have their stormwater treatment technologies verified and certified by the Washington State TAPE program. This guide walks proponents through the TAPE process, providing an overview of the program and the specific steps required for certification. Specific guidance for designing, executing, and reporting on performance monitoring is detailed in two companion Ecology documents:

- [*Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology \(TAPE\)*](#)
(Publication 11-10-061) (*aka*, TAPE Technical Guidance Manual)
- [*Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*](#)
(Publication 04-03-030).

Ecology updated the TAPE Technical Guidance Manual in September 2018¹. Ecology may consider field data collected prior to September 2018 to satisfy the performance goals of TAPE. Previously collected field data must meet either the 2011 or the 2018 TAPE guidelines and include an Ecology approved Quality Assurance Project Plan, and third party review confirming that monitoring was conducted and samples were analyzed in accordance with the cited TAPE protocol and the approved QAPP. TAPE requires all new applicants to pay a fee at three stages in the certification process. Please refer to the Fee Structure Program for a description of these fees.

Overview of TAPE

The TAPE program provides a peer-reviewed regulatory verification and certification process for emerging stormwater treatment technologies. The TAPE program is administered by the Washington State Department of Ecology (Ecology), with assistance from staff at the Washington Stormwater Center (www.wastormwatercenter.org/), which provides stormwater management assistance including guidance on certification of emerging treatment technologies.

The stormwater management manuals for western and eastern Washington include design criteria and performance goals for stormwater treatment facilities in the state of Washington ([stormwater management manuals](#)). Volume V, Chapter 12 (Stormwater Management Manual for Western Washington (SWMMWW)) and Chapter 5, Section 12 (Stormwater Management Manual for Eastern Washington (SWMMEW)) of the manuals discuss Ecology's evaluation and approval process for emerging treatment technologies. The stormwater manuals do not provide criteria for the selection and sizing of emerging technologies because the technologies and the knowledge of them are rapidly evolving.

¹ Proponents accepted into the TAPE program prior to September 2018 may choose to follow either the new protocol (September 2018) or the old protocol (July 2011). Proponents submitting a technology to the TAPE program for the first time can choose between the new protocol and the old protocol until March 31, 2019, after which your QAPP must follow the new protocol. Your QAPP must state which of the two protocols is followed.

Ecology and the Washington Stormwater Center established a Board of External Reviewers (BER) to:

- Review emerging treatment technology design and performance data and recommend whether or not to certify the technology.
- Provide overall advice and guidance as the TAPE program evolves and improves.

Proponents must demonstrate performance by testing their stormwater treatment technology at field sites in the Pacific Northwest or at pre-approved testing sites located in other parts of the United States. The testing protocol is specifically designed to evaluate flow-through best management practices (BMPs) with relatively short detention times, and may not be suitable for all stormwater treatment technologies. Ecology has developed an alternative monitoring protocol that applies to long-detention BMPs (e.g., wet ponds) (Ecology 2018b). This document is included as an Appendix in the [*Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies*](#).

Based on BER technical reviews, Washington Stormwater Center staff members advise Ecology regarding which new stormwater treatment technologies meet performance goals and therefore, should be added to the list of approved technologies in the stormwater management manuals. Ecology makes the final decision to certify new stormwater treatment technologies.

Criteria for certification

Certification of emerging technologies depends on their performance relative to one or more of five performance goals (Table 1).

Table 1. TAPE Performance Goals^a

Performance Goal	Influent Range	Criteria
Basic Treatment	20-100 mg/L TSS	Effluent goal < 20 mg/L TSS
	100-200 mg/L TSS	≥ 80% TSS removal
Dissolved Metals Treatment	Dissolved copper 0.005 - 0.02 mg/L	Must meet basic treatment goal and exhibit ≥ 30% dissolved copper removal
	Dissolved zinc 0.02 - 0.3 mg/L	Must meet basic treatment goal and exhibit ≥ 60% dissolved zinc removal
Phosphorus Treatment	Total phosphorus (TP) 0.1 to 0.5 mg/L	Must meet basic treatment goal and exhibit ≥ 50% TP removal
Oil Treatment	Total petroleum hydrocarbon (TPH) > 10 mg/L	1) Daily average effluent TPH concentration < 10 mg/L 2) Maximum effluent TPH concentration of 15 mg/L for a discrete (grab) sample
Pretreatment ^b	50-100 mg/L TSS	< 50 mg/L TSS
	100-200 mg/L TSS	≥ 50% TSS removal
mg/L - milligrams per liter TP - total phosphorus TPH - total petroleum hydrocarbons TSS - total suspended solids a. See TAPE Technical Guidance Manual for further details. b. Pretreatment technologies generally apply to (1) project sites using infiltration treatment and (2) treatment systems where pretreatment is needed to ensure and extend performance of the downstream basic or dissolved metals treatment facilities.		

Use level designations

Ecology evaluates the existing data on a stormwater treatment technology to assign use level designations that determine how many installations may occur in Washington and what the monitoring requirements are for obtaining additional data on treatment performance. Depending on the relevance, amount, and quality of performance data provided with the application for certification, Ecology will initially place the technology into one of two use level designation categories: pilot use level designation (PULD) or conditional use level designation (CULD) (Table 2). PULDs are typically given when there are sufficient laboratory data available to indicate a treatment technology may meet the performance goals for TAPE that are described in Table 1. Ecology typically issues CULDs when there are both laboratory and field data available for a treatment technology that would indicate an even greater likelihood of meeting these performance goals. Applicants may use field data that does not meet the data requirements of TAPE for CULD approval. The PULD and CULD allow installation and operation of the technology in the state of Washington in order to gather the performance data required for final general use level designation (GULD) certification. More information on the [TAPE program](#) is available on Ecology’s website.

Table 2. TAPE Use Level Designations

Use Level Designation	Minimum Data Required for Certification ^a	Time Limit (months) ^b	Maximum Number of Installations in Washington State	Field Testing Required Under Designation to achieve GULD
Pilot (PULD)	Laboratory	30	5 ^c	A minimum of one site located in the Pacific Northwest or at an approved Alternative Stormwater Technology Evaluation Facility; <i>all</i> sites installed in Washington state must be monitored ^d
Conditional (CULD)	Field data required; laboratory data may supplement but not substitute for required field data.	30	10 ^c	A minimum of one site located in the Pacific Northwest or at an approved Alternative Stormwater Technology Evaluation Facility
General (GULD)	Field data following TAPE protocol required; laboratory data may supplement but not substitute for required field data	Unlimited	Unlimited ^e	None
<p>a. Proponent must supply all available performance data with the initial application. PULD and CULD approvals will depend on the relevance, amount, and quality of data. Submittal of data does not ensure approval.</p> <p>b. From the time the original use level designation is received from Ecology. Proponents with a PULD or CULD are typically allowed a maximum of 30 months to prepare a QAPP, receive QAPP approval, conduct stormwater monitoring according to the QAPP, and prepare a TER requesting CULD or GULD certification for their stormwater treatment technology. Proponents requiring extensions on the 30-month use level designation, or the submittal of a QAPP or TER, must submit a request to Ecology at least 2 weeks before the due date. Ecology will grant extensions only if the proponent shows that progress is being made toward completing required TAPE components.</p> <p>c. Installation limit applies to devices installed to meet new and redevelopment treatment criteria. There is no installation limit for stormwater retrofit or industrial permit projects.</p> <p>d. Local governments covered by a municipal stormwater National Pollutant Discharge Elimination System (NPDES) permit must submit a Notice of Intent form to Ecology when a PULD technology is proposed for installation in their jurisdiction.</p> <p>e. Subject to conditions imposed by Ecology (i.e., maximum flow rates, limitations on drainage basin size, locations for use, and others as appropriate) listed in the GULD document posted on Ecology's website. Local jurisdictions may impose additional conditions.</p>				

What does certification mean?

Ecology designed the TAPE certification process to ensure that the approved treatment technologies meet applicable design criteria and performance goals for new development and redevelopment. TAPE certification means that the new technology has successfully met the TAPE performance goals, when they properly install, operate, and maintain the device.

However, TAPE certification does not mean the technology is appropriate for any and all stormwater treatment applications. Local governments should use TAPE certification as one of many factors when selecting or allowing specific stormwater control and water quality treatment solutions for use in their jurisdiction. Jurisdictions should base selection of a treatment technology on a cost-benefit analysis and not simply on the fact that a technology is TAPE-certified. Although TAPE is a Washington State protocol, several other states, counties, and cities use TAPE certification to determine whether to allow installation of a technology within their jurisdiction.

The TAPE performance goals do not address capital costs, costs for operation & maintenance (O&M), or costs for material disposal; however, proponents are encouraged to provide this supplemental information in their Technical Evaluation Report (TER). In addition, the TAPE certification process represents specific influent concentration ranges and does not typically include an assessment of long-term performance. Local governments should take these and other factors, into account when evaluating the potential use of a TAPE-certified treatment technology.

There is no specific analysis of maintenance frequency within the TAPE review process. The same device will require different maintenance activities depending on the land use upstream of the device. With only one field site required, TAPE does not address general maintenance requirements.

Steps to certification

Step 1. Complete the *Emerging Stormwater Treatment Technologies: Initial Application for Certification (Initial Application)* and pay the application fee. A copy of the Initial Application form is included in the [Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology \(TAPE\)](#). The *Initial Application* includes information about your technology and the performance data you have collected to help us evaluate whether your technology shows promise of meeting the TAPE performance goals. If an application contains confidential business information (CBI), you must identify the information in your application. Ecology will consider if the information, according to WA state law, is confidential and inform you of our findings. Ecology will not share confidential information with others.

When we receive a completed *Initial Application*, we will assign your technology a case number and contact you if any additional information is required. The Washington Stormwater Center may ask up to three members of the BER to review and provide comments on the application. If after reviewing this information Ecology finds that your technology shows promise of meeting TAPE goals, Ecology will grant your technology either a pilot or a conditional use level designation (PULD or CULD). Our goal is to grant a use level designation within one to two months from receipt of your complete *Initial Application*. Once the proponent finds a suitable monitoring site and notifies Ecology, the deadlines for QAPP and TER submittal are set.

Initial Application:

Submit one (1) text-searchable electronic (.pdf) copy, and one (1) signed copy of the TAPE confidentiality agreement

Your *Initial Application* must include as much of the following information as possible. If using data from testing following other protocols, describe how data is similar to or differ from TAPE guidelines (e.g., storm depth, sample type). If you provide insufficient information in your *Initial Application*, Ecology will return the application to you without review, pending receipt of adequate information. At a minimum, applicants should submit the following information:

- Description of physical, chemical, and/or biological treatment functions.
- Design drawings/photographs.
- Description of construction materials.
- Equipment dimensions.
- Design flow rate (gallons per minute [gpm], cubic feet per second [cfs], inches per hour [in/hr]).
- Explanation of site installation requirements (e.g., necessary soil characteristics, hydraulic grade requirements, depth to groundwater limitations, utility requirements).
- Description of any pretreatment requirements or recommendations.
- Description of any components of the treatment system that may contain copper, zinc, or phosphorus or any other constituent of concern that might contribute to increased pollutant concentrations in the effluent.
- Description of any components (i.e., concrete) that may result in pH fluctuations in the effluent.
- Detailed description of the sizing methodology.
- Expected treatment capabilities.
- Maintenance procedures.
- Description of bypass process.
- Comparison of size of laboratory unit to typical field units (if laboratory testing data is submitted).
- Raw water quality data.
- Summary of water quality data and removal calculations.
- Statistical analysis.
- Flow rate(s) used for laboratory testing.
- Influent and effluent flow data.
- Storm event information.
- Any other information or data that will help determine if your treatment technology can meet or does meet TAPE's performance goals.

Step 2. Design a performance evaluation study and write a Quality Assurance Project Plan (QAPP). The study must generate performance data of sufficient quality and quantity to evaluate with adequate statistical power how the technology performs in the field. Detailed

guidance for designing your study, including how to write the QAPP is provided in the *TAPE Technical Guidance Manual* and in Ecology's *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* (Website links identified earlier). Finding a field site with suitable stormwater flows and influent ranges specified in the *TAPE Technical Guidance Manual* and Table 1 of this document is often challenging; consequently, proponents are encouraged to identify sites early in the process of designing the study.

Selecting multiple field sites is often advantageous to the proponent; the QAPP must address field conditions at each field site where data collection will occur. Local governments covered by a municipal stormwater National Pollutant Discharge Elimination System (NPDES) permit must submit a Notice of Intent form (Appendix 3) to Ecology for every PULD technology proposed for installation in their jurisdiction.

QAPP:

Submit one (1) text-searchable electronic (.pdf) copy. Proponents with a PULD must include a copy of the completed Notice of Intent form (Appendix 3) with the QAPP.

Refer to the TAPE confidentiality section below for submittal requirements for QAPPs containing confidential business information.

At least three experts chosen from the BER will review the completed QAPP. The BER member review addresses the following question:

If the monitoring program described in the proponent's QAPP is substantively followed and completed, will the resulting data and statistical analyses allow Ecology to rigorously evaluate the technology's performance against the stated TAPE performance goals?

Washington Stormwater Center staff will consolidate comments from the three BER members and forward the consensus recommendation to Ecology. There may be several steps in the review process as Ecology requests additional information from the applicant. If there is substantial disagreement among the external reviewers, we may request that additional BER members review the QAPP. The final decision to approve the QAPP rests with Ecology.

The proponent must submit a QAPP that meets Ecology's QAPP guidance and *TAPE Technical Guidance Manual* requirements within six months of finding a suitable monitoring site and notifying Ecology. Within three months² of receipt of the final QAPP, Ecology will complete the review and make a decision whether field testing can commence.

Step 3. Install, operate, and monitor the technology at one or more field sites in the Pacific Northwest or at an Ecology-approved Alternative Stormwater Technology Evaluation Facility. A list of approved facilities can be found on the Ecology website.

² If circumstances prevent completion of Ecology's review within the stated review period, Ecology will notify the proponent of the reason for the delay and provide an estimated review schedule.

Ecology must approve the QAPP prior to the start of field-testing. The proponent must use the approved QAPP to guide project management during this phase of the certification process. While Ecology and the Washington Stormwater Center staff are available to discuss issues arising during the field study, the proponent's project team is responsible for monitoring the site(s) according to the QAPP.

Step 4. Send us the results. Upon completion of the field sampling, use the data analysis and statistical techniques described in your approved QAPP to summarize the results and write the Technical Evaluation Report (TER). Instructions for completing the TER are found in the *TAPE Technical Guidance Manual*. Note that an independent professional third party must review key elements of the TER for all submittals that contain field monitoring data collected by a vendor or manufacturer of a stormwater treatment technology before you send it to us for review. Proponents must fill out the Excel database template with raw field data, storm data, and site information. Ecology will forward this information to the International Stormwater Database following final GULD approval.

TER:

Submit one (1) text-searchable electronic (.pdf) copy, and one (1) .CSV file with raw analytical and storm event data.

Refer to the TAPE confidentiality section below for submittal requirements for TERs containing confidential business information.

We will review each TER for completeness and then ask at least three members of the BER to conduct a thorough examination of your results, interpretations, and findings. For consistency whenever possible, TAPE will use the same reviewers who evaluated your QAPP for the review of the TER. TAPE will compile the results of the external reviews and will send a summary recommendation to Ecology. There may be requests for more information from the BER or Ecology during the TER review. Ecology intends to complete the review of your TER and make a final certification decision within three months of receiving the TER. If Ecology approves the TER, the technology receives a GULD. At a minimum the GULD identifies the type of approved treatment (basic, dissolved metals, phosphorus, and/or oil), the design flow rate, and the required maintenance interval. Ecology is responsible for the final certification decision.

Submitting information to Ecology

Initial Applications, QAPPs, and TERs, along with the appropriate fees should be sent to the Washington State Department of Ecology, using the contact information provided below. [Fee information is provided at the end of this document.](#)

<p>Send the following:</p> <ul style="list-style-type: none"> • Applications • QAPPS • TERS • Fees 	<p>Please make checks payable to:</p> <p><i>Department of Ecology</i></p>
<p>Send to:</p> <p style="text-align: center;">TAPE Program Washington State Department of Ecology Cashiering P.O. Box 47611 Olympia, WA 98504-7611</p>	
<p>Questions?</p> <p>(360) 407-7052 ldar461@ecy.wa.gov</p>	

Confidentiality

Proponents may request that certain records or other information be considered confidential. Such requests will be considered by Ecology consistent with Washington State law (RCW 43.21A.160). In order for such records or information to be considered confidential, the proponent must certify that the records or information is unique to the design and construction of the technology, or release to the public or to a competitor would adversely affect the competitive position of the proponent. The proponent must request that such records or information be made available only for the confidential use of Ecology. All monitoring data including, but not limited to, laboratory results and field measurements, QA/QC data, data qualifiers, and monitoring site information cannot be considered confidential.

To make a request for confidentiality, the proponent must clearly mark only those pages that contain confidential material with the word “confidential” and submit these pages as a separate file to Ecology. Placeholder pages must be placed in the document that state “confidential material has been provided as a separate document to Ecology.” The proponent must also provide a letter of explanation as to why these pages are confidential. Ecology will review the request and send notice to the proponent either granting or denying the confidentiality request. Proponents may request return of material if Ecology denies the request for confidentiality. At a minimum, requests for confidentiality require a 1-month review.

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TAPE Fee Structure

Fee Structure for Program Participation

Fee category	Amount	Due
Initial Application	\$ 5,000	Upon submittal of <i>Initial Application</i>
Quality Assurance Project Plan (QAPP) review	\$ 10,000	Upon submittal of final QAPP ^a
Technical Evaluation Report (TER) review	\$ 15,000	Upon submittal of final TER ^b
<p>a. Fee must be paid before Ecology updates the TAPE website to reflect the change in the technology's status. Collection of fee does not guarantee approval of QAPP.</p> <p>b. Fee must be paid before Ecology updates the TAPE website to reflect the technology's new General Use Level Designation (GULD). Collection of fee does not guarantee approval of TER or guarantee GULD status.</p>		
<p>Please make checks payable to: Department of Ecology and send to: TAPE Program Washington State Department of Ecology, Cashiering, P.O. Box 47611, Olympia, WA 98504-7611</p>		

TAPE is administered by the Washington State Department of Ecology with assistance from staff at the Washington Stormwater Center. The Washington Stormwater Center is a partnership between the City of Puyallup, the University of Washington Tacoma, and the Washington State University Puyallup Research and Extension Center.

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Appendix 1. Acronyms

BER	Board of External Reviewers
BMP	Best management practices
CULD	Conditional Use Level Designation
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and maintenance
PULD	Pilot Use Level Designation
QAPP	Quality Assurance Project Plan
TAPE	Technology Assessment Protocol-Ecology
TER	Technical Evaluation Report
TP	Total phosphorus
TPH	Total petroleum hydrocarbons
TRC	Technical Review Committee
TSS	Total suspended solids

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Appendix 2. References

Ecology 2004. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*, No. 04-03-030. Washington State Department of Ecology, Olympia, WA. (www.ecy.wa.gov/programs/eap/qa/docs/QAPPtool/Mod3%20Guidelines/GuidelinesforPreparingQAPPS.pdf)

Ecology 2012. *Stormwater Management Manual for Western Washington*, No. 05-10-029, 05-10-030, 05-10-031, 05-10-032, 05-10-033. Washington State Department of Ecology, Olympia, WA. (www.ecy.wa.gov/programs/wq/stormwater/manual.html)

Ecology 2018a. *Guidance for Evaluating Emerging Stormwater Treatment Technologies-Technology Assessment Protocol – Ecology (TAPE)*, No. 11-10-061, a revision of No. 02-10-037. Washington State Department of Ecology, Olympia, WA. (www.ecy.wa.gov/biblio/0210037.html)

Ecology 2018b. *Guidance for Evaluating Emerging Stormwater Treatment Technologies-Technology Assessment Protocol—Ecology (TAPE) Appendix: Modification: Evaluating Stormwater Treatment Technologies with Long Detention Times*. Washington State Department of Ecology, Olympia, Washington.

Ecology 2018c. *Stormwater Management Manual for Eastern Washington*, No. 04-10-076. Washington State Department of Ecology, Olympia, WA. (www.ecy.wa.gov/programs/wq/stormwater/easternmanual/manual.html)

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Appendix 3. Notice of Intent Form for PULD Technologies

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Notice of Intent

Pilot Use Level Designation Technologies

Treatment Facility Vendor Information

Company:		Contact Name:	
Business Phone:	Fax (optional):	Street Address:	
Company Web Address:			
Email:	City:	State:	Zip+4:
Facility Name and Size:			
Development Level Designation Sought:			
Target Pollutants:			

Project Information

Project Name:		Contact Name:	
Local Agency with Jurisdiction:		Street Address:	
Desired Installation Date:			
Project Type:		City:	
Facility Discharge Receiving Water:			
Describe Proposed Testing Plan (e.g. number storms, parameters, test period, who will do work, etc.):			

Local Government Certification and Acceptance

Printed/Typed Name	Agency	Title
Signature	Date	

Submit completed forms to the following address:

Washington Department of Ecology – TAPE Coordinator
Water Quality Program
PO Box 47696
Olympia, WA 98504-7696

If you have questions about this form, contact the following Ecology staff:

Douglas Howie at (360) 407-6444 or douglas.howie@ecy.wa.gov

Background Information

Local governments with a National Pollutant Discharge Elimination System (NPDES) permit must submit this Notice of Intent Form to Ecology, and receive Ecology's approval prior to installing a pilot-designated technology (except in retrofit situations). All other jurisdictions are also encouraged to notify Ecology when a Pilot Use Level Designation (PULD) technology is proposed.

Local governments may allow PULD technologies to be installed **provided that** the vendor and/or developer agree(s) to conduct additional field testing based on the TAPE at **all** installations to obtain a general use level designation (GULD). Field-testing must be completed at a minimum of one site in the Pacific Northwest*, or at a pre-approved testing site located in other parts of the United States, to obtain a general use level designation.

* *Pacific Northwest refers to locations in Washington, Oregon, Northern California or British Columbia with rainfall distributions typical of a Pacific Northwest maritime climate, where long duration, low intensity storms predominate and stormwater contains mostly silt sized particles.*

To request materials in a format for the visually impaired, visit <https://ecology.wa.gov/accessibility>, call Ecology at 360-407-6600, Relay Service 711, or TTY 877-833-6341.