TECHNICAL MEMO: ILLICIT CONNECTION-ILLICIT DISCHARGE LITERATURE REVIEW

Update to Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual

Prepared for: King County Department of Natural Resources and Parks, Stormwater Services Section

Project No. 170193-203 • June 30, 2019

Aspect CONSULTING

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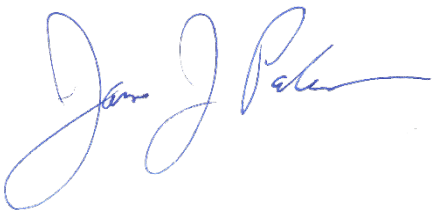
Aspect Consulting, LLC
in cooperation with Herrera Environmental Consultants



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Introduction

This technical memorandum provides a summary of a literature review performed by Aspect Consulting LLC (Aspect) for King County's project *Update Illicit Connection and Illicit Discharge Guidance Manual (IC-ID Manual) and Trainings* project[1]. Information from this literature review is part of the source information being used to update the IC-ID Manual originally developed by King County, the Washington Stormwater Center, and Herrera Environmental Consultants in 2013 (King County, 2013). As a project of the Washington State Department of Ecology's (Ecology) Stormwater Action Monitoring (SAM) program, this work is receiving technical oversight by the Source Identification subgroup of SAM.

The updated IC-ID Manual will provide a helpful and timely resource for municipal illicit discharge detection and elimination (IDDE) field screening and source tracing activities. The timing of the updated manual is intended to coincide with the 2019 reissuance of Washington municipal stormwater permits under the National Pollutant Discharge Elimination System (NPDES). In Washington, IDDE activities are required for both Phase I and Phase II jurisdictions covered by the municipal stormwater permits.

Literature Review

Per the scope of work, the literature review sought to identify publications with new or updated field methods that could be incorporated into the IC-ID Manual. The search for publications included internet and online database searches to identify relevant publications. The search resulted in 20 publications that were selected to be reviewed, including manuals, guidance documents, permit annual reports, presentation/training slides, method protocols, and journal articles. The publications reviewed for this literature review span four categories:

- Western Washington municipal publications: local government IDDE program manuals and Quality Assurance Project Plans (QAPPs)
- Non-Washington municipal publications: local government manuals, annual reports, and presentation/training slides
- Federal publications: guidance documents, protocols, and a technical memorandum
- Academic journal articles

Publications were reviewed and compared to the 2013 IC-ID Manual's field screening methodologies, indicators, and source tracing methodologies. The review identified

[1] King County project P00235P18/6026336

methods or tests that were either not covered in the 2013 IC-ID Manual or included but without much detail. The occurrence of specific methodologies and indicators in the publications reviewed is used to suggest ideas for updates to the IC-ID Manual, which can be considered based on other input received (e.g. feedback workshops that occurred previously) and follow-up research into their effectiveness.

The complete list of reviewed publications is provided in Table 1; subsequent tables refer to only the jurisdiction and reference type for simplicity rather than the publication names. Table 2, Table 3, and Table 4 provide crosswalks of the reviewed publications and the 2013 IC-ID Manual's field screening methodologies, indicators, and source tracing methodologies, respectively. All tables are included at the end of this memorandum, and weblinks to the publications are provided in the References list below.

Western Washington Municipal Publications

Many western Washington jurisdictions have published their own IDDE program manuals, many of which are adapted from either the 2013 IC-ID Manual or the 2004 Center for Watershed Protection IDDE guidance manual (CWP 2004). These jurisdiction-specific manuals were prepared as part of municipal efforts to comply with the IDDE section of the municipal stormwater permits (Section S5.C9 for Phase I jurisdictions and S5.C5 for Phase II jurisdictions). The previous and current permits require *"implement[ing] a field screening methodology appropriate to the characteristics of the [municipal separate storm sewer system] MS4 and water quality concerns"* or adopting a comparable methodology. The previous permits (2013-2018 and 2018-2019) referred to the 2004 CWP manual as a comparable methodology, and the current permits (2019-2024) refer to the 2013 IC-ID Manual instead of the 2004 CWP manual.

Publications from 2012 and later were prioritized for review since the literature review performed for the 2013 IC-ID Manual included publications before 2012. The current literature review also focuses on documents that are IDDE-specific program manuals from a variety of municipal entities. A total of five IDDE manuals from western Washington municipalities were selected as part of this literature review:

1. Illicit Discharge Detection and Elimination Program Manual (Bothell, 2012)
2. Illicit Discharge Detection and Elimination Program Manual (Camas, 2016)
3. Municipal Stormwater Illicit Discharge Detection and Elimination (IDDE) Program (Kelso, 2015)
4. Illicit Discharge Detection and Elimination Program Quality Assurance Project Plan (Seattle, 2014)
5. Illicit Discharge Detection and Elimination Program Manual (Washougal, 2012)

As shown in Table 2, all IDDE manuals reviewed from western Washington included outfall screening, catch basin or manhole inspections, and video/closed circuit television (CCTV) inspections for field screening methodologies. However, only the City of Seattle included additional field screening methodologies, including ditch inspections and business inspections in their IDDE Program QAPP.

For indicators (summarized in Table 3), all five jurisdictions included flow, color, odor, turbidity, visual indicators, and detergents/surfactants in their IDDE documentation. Several jurisdictions also included pH, temperature, ammonia, potassium, conductivity, and bacteria. Seattle and Washougal specified the bacteria type, which was *Escherichia coli (E. coli)* and fecal coliform (Seattle) and *E. coli*, *enterococci*, and total coliform (Washougal). None of the jurisdiction publications reviewed listed the use of nitrate.

For source tracing methodologies (summarized in Table 4), all five jurisdictions included dye testing and smoke testing. The City of Camas also included optical brighteners in their IDDE Program Manual, and the City of Seattle included stream walks in their IDDE Program QAPP. None of the jurisdiction publications reviewed included sand-bagging, septic system inspections, vehicle/foot reconnaissance, or aerial photography as a source tracing methodology.

In addition, the Washougal and Kelso manuals mention additional indicators noted below that are not included in the 2013 IC-ID Manual. The first four were from Washougal and the last one is from Kelso.

- Caffeine
- DNA of microorganisms
- Fecal sterols
- Oxygen stable isotope
- Visual indicator: sediment build-up (Kelso only)

Non-Washington Municipal Publications

Many non-Washington municipal IDDE publications are also available online. As with western Washington, many municipalities across the country have published and implemented IDDE procedures to comply with their NPDES permits. Some regions were represented more than others, such as the northeastern states. This may reflect the influence of the northeastern region on the field of IDDE with some of the earliest publications. These include the CWP's 2004 IDDE Manual (CWP 2004) published by the Environmental Protection Agency (EPA) and a 2003 IDDE manual published by the New England Interstate Water Pollution Control Commission (NEIWPCC 2003).

The non-Washington municipal publications selected for review were published recently (in the last three years) and include the following.

1. Illicit Discharge Detection and Elimination Plan (Central Massachusetts Regional Stormwater Coalition [CMRSC], 2016)
2. MS4 Permit Changes in Delaware: Will You be Ready? (Delaware Department of Transportation, undated)
3. Easthampton MA NPDES PII Small MS4 General Permit Annual report (Easthampton, MA, 2018)

4. Illicit Discharge Detection and Elimination Program Manual (Grand Island, NE, 2017)
5. Illicit Discharge Detection and Elimination Manual (Haverhill, MA, 2018)
6. Illicit Discharge Detection and Elimination Guidance Manual (Valdosta, GA, 2016)
7. Illicit Discharge Elimination Program (IDEP) (Wayne County, MI, 2016)

As shown in Table 2, most of the IDDE documentation reviewed from non-Washington municipalities included outfall screening, catch basin or manhole inspections, and video/CCTV inspections for field screening methodologies. Business inspections and best management practice (BMP) inspections were listed in one of the publications reviewed. Ditch inspections and automated sampling also were mentioned in two of the non-Washington publications reviewed.

For indicators (Table 3), all of the publications reviewed included flow, odor, and temperature. All but one jurisdiction indicates the use of use bacteria, though only two specified which type(s). Most of the publications reviewed included ammonia, color, pH, turbidity, visual indicators, detergents/ surfactants, and conductivity. Some of the publications reviewed included chlorine, fluoride, nitrate, and potassium. None of the publications reviewed included hardness as an indicator.

For source tracing methodologies (Table 4), some of the publications reviewed included dye testing and smoke testing, and most included focused/intensive sampling as a source tracing methodology. Optical brighteners were included in two publications as was sand-bagging, and vehicle/foot reconnaissance was mentioned in one publication. None of the non-Washington publications reviewed included septic system inspections, aerial photography, or stream walks.

Some of the non-Washington municipal publications mentioned the following indicators that are not included in the 2013 IC-ID Manual.

- Chemical oxygen demand (COD)
- Pharmaceuticals
- Salinity
- Total suspended solids
- Visual indicator: pipe benthic growth
- Visual indicator: sediment build-up

In addition, some of the non-Washington publications reviewed listed the following as primary indicators associated with sample collection and analysis. These indicators are listed under "Other" or as secondary tests in the 2013 IC-ID Manual but are not described in detail:

- Biochemical oxygen demand (BOD)
- Dissolved oxygen
- Total dissolved solids
- Total Kjeldahl nitrogen (TKN)
- Total phosphorus
- Total petroleum hydrocarbons (TPH)

Federal Publications

Four federal IDDE publications were selected for review from internet searches. They comprise a technical memorandum, a guidance document, a protocol promulgated by the EPA New England region, and a manual written by a consultant for a large military base in Eustis, Virginia. As with municipalities, guidance from federal entities is tied to the NPDES program and includes many of the same methodologies implemented at a local level. The publications selected for review run the gamut from recent (2016) to relatively old for this subject (2002) and capture current approaches as well as some early IDDE framework that led to the 2004 CWP IDDE Manual. The federal publications reviewed include the following:

1. Techniques for Identifying and Correcting Illicit and Inappropriate Discharges Technical Memorandum (CWP, 2002)
2. Illicit Discharge Detection and Tracking Guide (CWP, 2011)
3. EPA New England Stormwater Outfall Sampling Protocol (EPA, 2012)
4. Final IDDE Procedure Manual for Joint Base Langley Eustis (JBLE)-Fort Eustis, Virginia (JBLE, 2016)

As shown in Table 2 for field screening methodologies, all publications reviewed from federal entities included outfall screening, and most include the use of video/CCTV inspections. Two publications included ditch inspections, and one publication included catch basin or manhole inspections and focused/intensive sampling. None of the publications reviewed included business or BMP inspections or automated sampling.

For indicators (Table 3), all of the publications reviewed included odor and visual indicators, and most of the publications reviewed included flow, ammonia, color, turbidity, surfactants, and conductivity. Some of the publications reviewed included pH, temperature, chlorine, fluoride, hardness, bacteria, nitrate, and potassium. Two publications specified the bacteria type and two did not.

For source tracing methodologies (Table 4), most of the federal publications reviewed included dye testing and smoke testing, and a few publications mentioned sand-bagging, aerial photography, and stream walks. None of the publications reviewed included septic system inspections or vehicle/foot reconnaissance.

In addition, some of the federal publications reviewed mentioned the following additional indicators that are not included in the 2013 IC-ID Manual:

- DNA microorganisms
- Fluorescence
- Pharmaceuticals (EPA method 1694)
- Salinity
- Ultraviolet absorbance
- Visual indicator: pipe benthic growth

Academic Journal Articles

In addition to municipal IDDE manuals and federal publications, a limited search of academic journals was performed. The search was done using the online EBSCO database available through the University of Washington libraries. While only a few environmental science and engineering-related journals are included in EBSCO, the search did turn up some useful information.

Four journal articles were identified and review with information relevant to stormwater source identification investigations. The articles were focused on reporting research and not intended to describe IDDE programs; therefore, the articles are listed and described below, but not included in Table 2, Table 3, or Table 4.

Safferman et al. (2011) used soil moisture and soil oxygen sensors to predict metals leaching from soil under various BOD concentrations. This work supports considering what leachates may be present in illicit discharges from contaminated soil and could be investigated by monitoring soil moisture and dissolved oxygen in soil areas of concern.

Machusick et al. (2011) recorded temporary groundwater mounding from bioinfiltration BMPs at Villanova University. They measured precipitation, groundwater level, and groundwater temperature and concluded that impacts from stormwater infiltration had only localized temporary effects and didn't negatively impact the water table. These results support using temperature to differentiate groundwater from surface water inputs where illicit discharges may infiltrate.

Hathaway and Hunt (2012) documented *E. coli* and *enterococci* bacteria export from wet ponds, bioretention cells, and wetlands all designed for stormwater treatment. This work supports considering bacteria storage and transport in stormwater treatment BMPs when tracing bacterial sources.

Zhang and Olson (2012) investigated metal adsorption to bacteria in soil and water. Dissolved metals can reduce the negative charge of bacterial surfaces. This reduces

repulsive forces between soil and bacteria and creates favorable conditions for metal adsorption and bacterial attachment to soil particles. This information supports reviewing bacteria and metals results together from samples of discharge and of soil to investigate the fate of illicit discharges that contain metals and infiltrate into the ground.

The articles reviewed highlight an important research area of focus on soil and groundwater interactions with infiltrated stormwater or other discharges. While infiltration can be an effective temporary storage method or treatment for runoff and some discharges, the potential impacts to soil and shallow groundwater is not well known. Areas where illicit discharges infiltrate can accumulate solids or other toxins and have the potential to become sources of illicit discharges themselves. This includes swales, ditches, unpaved roads, or whatever exposed ground is nearest an illicit discharge.

This brief review of one area of academic research in stormwater supports considering the inclusion of using soil or solids testing in areas where illicit discharges infiltrate. Doing so may help with source tracing efforts by identifying changes in the soil or solids chemistry, temperature, or bacteria. In the context of IDDE programs this would likely be an advanced step for discharges that have occurred over time and where the soil or solids has the potential to enter the MS4. Based on the research articles reviewed here, soil/solids indicators could include bacteria, soil moisture, dissolved metals, and shallow groundwater temperature (e.g. interflow or mounded groundwater).

Literature Review Outcomes to Consider For the IC-ID Manual Update

This literature review provides information and suggestions for potential updates to the IC-ID Manual. Several additional potential indicators were gleaned from the reviewed publications that are not presently in the IC-ID Manual or are present but not described in much detail. These indicators are summarized below and can be considered for inclusion in the updated manual with some follow-up research into the specific tests or methods involved. None of the literature reviewed indicated the use of new or different field screening or source tracing methodologies that what are included in the IC-ID Manual already.

In addition, the literature review resulted in some suggestions about the order of presentation of the resources (field screening methodologies, indicators, and source tracing methodologies) in the IC-ID Manual and how they might be prioritized. The most commonly included methodologies and indicators are summarized below and can be considered for prioritizing in their presentation in the IC-ID Manual. Commonality of usage is only one consideration for a given indicator, however. Other factors not covered in this literature review should also be considered, such as cost, ease of implementation, and effectiveness.

Field Screening Methodologies

Given the inclusion of the various field screening methodologies in the literature reviewed here, some could be considered for prioritizing in the IC-ID Manual, which are presented alphabetically currently. The methodologies in most frequent use could be listed first and emphasized as the most effective, such as outfall screening, video inspections, and catch basin/manhole inspection. Likewise, the least-used field screening methodologies could be moved to the bottom of the list, such as ditch inspections or into the Other category, such as stormwater BMP inspections.

No new or different field screening methodologies were mentioned in the literature that aren't already included in the IC-ID Manual.

Indicators

As with the field screening methodologies, the inclusion of the various indicators in the literature reviewed here can be considered for reprioritizing or reordering. Tests for bacteria and detergents were commonly mentioned and could be considered for reprioritizing as a primary indicator. Where bacteria type was specified in the review publications, *E. coli* and *enterococci* were the mostly commonly referenced and can be considered for prioritization in the updated IC-ID Manual. Nitrate and hardness tests, however, were infrequently mentioned and could be considered for deprioritizing or adding a fuller description describing the limited situations for their use. The indicators in the current IC-ID Manual listed low-cost ones first, and it is recommended that cost and level of effort also be weighed with reordering or reprioritizing indicators based on the literature reviewed.

The following additional aqueous indicators mentioned in the literature can be considered for inclusion in the updated IC-ID Manual:

- Caffeine
- Chemical oxygen demand
- DNA of microorganisms
- Fecal sterols
- Fluorescence
- Oxygen stable isotope (to distinguish major water body types)
- Pharmaceuticals using EPA method 1694
- Salinity
- Total phenols using a colorimetric test
- Toxicity using Microtox bioassay
- Ultraviolet light absorbance

Potential additional soil indicators include:

- Soil bacteria
- Soil moisture
- Dissolved metals in soil
- Shallow groundwater temperature

Some indicators that are secondary or listed as "other" in the IC-ID Manual are mentioned as primary indicators in some of the publications reviewed. These could be considered for reprioritizing as primary indicators in the IC-ID Manual.

- Biochemical oxygen demand
- Dissolved oxygen
- Total dissolved solids
- Total Kjeldahl nitrogen
- Total phosphorus
- Total petroleum hydrocarbons
- Total suspended solids

Source Tracing Methodologies

Given the inclusion of the various source tracing methodologies in some of the literature reviewed, a few of these methodologies could be considered for reprioritizing or reordering in the IC-ID Manual. Smoke and dye testing were noted to be used the most and the top candidates for source tracing reprioritizing. In addition, sand-bagging and reconnaissance were used by a few jurisdictions outside of Washington and could be considered for reprioritizing in appropriate investigative settings. Also, stream walks were included in Seattle's QAPP and in the 2011 CWP publication and likewise could be considered for prioritization.

No new or different source tracing methodologies were mentioned in the literature that aren't already included in the IC-ID Manual.

Table 1. Reviewed Publications

Jurisdiction/Journal	Title	Month, Year	Prepared By/Author	Reference Type
Western Washington Municipal Publications				
Bothell, WA	Illicit Discharge Detection and Elimination Program Manual	January 2012	City of Bothell, WA	Manual
Camas, WA	Illicit Discharge Detection and Elimination Program Manual	March 2016	City of Camas, WA	Manual
Kelso, WA	Municipal Stormwater Illicit Discharge Detection and Elimination (IDDE) Program	January 2015	City of Kelso, WA	Manual
Seattle, WA	Illicit Discharge Detection and Elimination Program QAPP	June 2014	City of Seattle, WA	QAPP
Washougal, WA	Illicit Discharge Detection and Elimination Program Manual	February 2012	City of Washougal, WA	Manual
Non-Washington Municipal Publications				
central Massachusetts	Illicit Discharge Detection and Elimination Plan, CMRSC	June 2016	Fuss & O'Neill for the Central Mass. Regional Stormwater Coalition	Manual
Delaware Dept of Transportation	MS4 Permit Changes in Delaware: Will You be Ready?	undated	KCI Technologies	Training presentation
Easthampton, Massachusetts	Easthampton MA NPDES PII Small MS4 General Permit Annual report	April 2018	City of Easthampton, MA	Annual Report
Grand Island. Nebraska	Illicit Discharge Detection and Elimination Program Manual	April 2017	City of Grand Island, NE	Manual
Haverhill, Massachusetts	Illicit Discharge Detection and Elimination (IDDE) Manual	January 2018	City of Haverhill, MA	Manual
Valdosta, Georgia	Illicit Discharge Detection and Elimination Guidance Manual	May 2016	City of Valdosta, GA	Manual
Wayne County, Michigan	Illicit Discharge Elimination Program (IDEP)	April 2016	Charter County of Wayne, MI	Manual
Federal Guidance				
Federal, EPA	Techniques for Identifying and Correcting Illicit and Inappropriate Discharges Tech Memo	October 2002	Center for Watershed Protection	Technical Memo
Federal, EPA	Illicit Discharge Detection and Tracking Guide	December 2011	Center for Watershed Protection	Guide
Federal, EPA	EPA New England Stormwater Outfall Sampling Protocol	January 2012	EPA New England	Protocol
Federal, Military	Final IDDE Procedure Manual for Joint Base Langley Eustis (JBLE)-Fort Eustis, Virginia	August 2016	AECOM Technical Services, Inc. for JBLE-Eustis	Manual
Academic Journal Articles				
J. Environmental Engineering	Predicting the Onset of Metal Leaching from Land Application of Wastewater Using Soil Sensors and Microbial Community Analyses	February 2011	Safferman, S.I, I.Fernandez-Torres, S.M Pfiffner, R.A Larson, D.L Mokma	Research article
J. Irrigation and Drainage Engineering	Groundwater Mounding at a Storm-Water Infiltration BMP	March 2011	Machusick, P.G, A. Welker, R. Traver	Research article
J. Irrigation and Drainage Engineering	Indicator Bacteria Performance of Storm Water Control Measures in Wilmington, NC	February 2012	Hathaway, J.M., W.F. Hunt	Research article
J. Environmental Engineering	Effect of Heavy Metals on Bacterial Attachment in Soils	November 2012	Zhang, H. and M.S. Olson	Research article

Table 2. Field Screening Methodologies Crosswalk with IC-ID Manual

		IC-ID Manual Field Screening Methodologies (o)							
Jurisdiction	**Reference Type**	**Business Inspections**	**Catch Basin or Manhole Inspections**	**Ditch Inspections**	**Outfall Screening**	**Stormwater BMP Inspections**	**Video Inspections**	**Other: Automated Sampling**	**Other: Intensive Sampling**
Western Washington Municipal Publications									
Bothell, WA	Manual		o		o		o		
Camas, WA	Manual		o		o		o		
Kelso, WA	Manual		o		o		o		
Seattle, WA	QAPP	o	o	o	o		o		
Washougal, WA	Manual		o		o		o		
Non-Washington Municipal Publications									
central MA	Manual				o		o		
Delaware DOT	Training presentation								o
Easthampton, MA	Annual Report	o	o		o	o	o		
Grand Island. NE	Manual		o		o				
Haverhill, MA	Manual		o		o		o		o
Valdosta, GA	Manual		o		o		o	o	o
Wayne County, MI	Manual		o	o	o		o		o
Federal Guidance									
Federal, CWP	Technical Memo				o		o		
Federal, CWP	Guide		o	o	o		o		
Federal, EPA	Protocol				o				
Federal, Military	Manual			o	o		o		o

Table 3. Indicators Crosswalk with IC-ID Manual

		IC-ID Manual Indicators (●)															
Jurisdiction	**Reference Type**	**Flow**	**Ammonia**	**Color**	**Odor**	**pH**	**Temper-ature**	**Turbidity**	**Visual Indicators**	**Chlorine**	**Detergents, Surfactants**	**Bacteria**	**Fluoride**	**Hardness**	**Nitrate**	**Potassium**	**Conductivity**
Western Washington Municipal Publications																	
Bothell, WA	Manual	●	●	●	●	●	●	●	●	●	●	● (unspecified type)	●			●	●
Camas, WA	Manual	●	●	●	●	●	●	●	●	●	●	● (unspecified type)		●		●	●
Kelso, WA	Manual	●		●	●			●	●		●						
Seattle, WA	QAPP	●	●	●	●	●	●	●	●		●	*E. coli* and fecal coliform	●			●	●
Washougal, WA	Manual	●	●	●	●	●	●	●	●	●	●	*E. coli*, *enteroccoci*, and total coliform	●			●	●
Non-Washington Municipal Publications																	
central MA	Manual	●	●	●	●	●	●	●	●	●	●	*E. coli and enteroccoci*			●		●
Delaware DOT	Training presentation	●	●		●	●	●		●		●	● (unspecified type)					
Easthampton, MA	Annual Report	●	●	●	●		●	●	●	●	●	● (unspecified type)			●		●
Grand Island. NE	Manual	●	●	●	●	●	●	●				*E. coli*	●			●	
Haverhill, MA	Manual	●	●	●	●	●	●	●		●	●	*E. coli*					●
Valdosta, GA	Manual	●			●	●	●	●			●	●	●				●
Wayne County, MI	Manual	●	●	●	●	●	●	●	●		●	*E. coli*					●
Federal Guidance																	
Federal, CWP	Technical Memo	●	●	●	●	●	●	●	●		●		●	●		●	●
Federal, CWP	Guide	●	●	●	●			●	●		●	*E. coli*, *enteroccoci*, and total coliform	●			●	●
Federal, EPA	Protocol		●		●		●		●	●	●	*E. coli* and *enteroccoci*			●		●
Federal, Military	Manual	●		●	●			●	●								

Table 4. Source Tracing Methodologies Crosswalk with IC-ID Manual

		IC-ID Manual Source Tracing Methodologies (x)							
Jurisdiction	**Reference Type**	**Dye Testing**	**Optical Brightener**	**Sand-bagging**	**Septic System Inspections**	**Smoke Testing**	**Vehicle/foot Reconnaissance**	**Other: Color or Infrared Aerial Photography**	**Other: Stream Walks**
Western Washington Municipal Publications									
Bothell, WA	Manual	x				x			
Camas, WA	Manual	x	x			x			
Kelso, WA	Manual	x				x			
Seattle, WA	QAPP	x				x			x
Washougal, WA	Manual	x				x			
Non-Washington Municipal Publications									
central MA	Manual	x	x	x		x			
Delaware DOT	Training presentation								
Easthampton, MA	Annual Report	x		x		x			
Grand Island. NE	Manual								
Haverhill, MA	Manual								
Valdosta, GA	Manual	x	x			x			
Wayne County, MI	Manual	x				x	x		
Federal Guidance									
Federal, CWP	Technical Memo	x				x		x	
Federal, CWP	Guide	x		x		x			x
Federal, EPA	Protocol								
Federal, Military	Manual	x				x			

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Limitations

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