

# TECHNICAL MEMO: IC-ID FEEDBACK WORKSHOPS AND SURVEY

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

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

Project No. 170193-200.01 • May 3, 2019 FINAL



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Aspect Consulting, LLC  
in cooperation with Herrera Environmental Consultants

A handwritten signature in blue ink, reading "James J. Packman".

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# Introduction

This technical memo provides the outcomes of two activities of King County project P00235P18/6026336 Update Illicit Connection and Illicit Discharge (IC-ID) Guidance Manual and Trainings (King County and WSU, 2013). Those two activities were to obtain feedback from municipal stormwater staff on their usage of the 2013 IC-ID Manual and suggestions for improvement to it. Feedback from municipal staff was obtained via an online survey and two in-person feedback workshops. Information from the workshops and survey will be used to update the IC-ID Manual as one of the primary goals of the overall project. The updated Manual is intended to help municipal stormwater permittees with the programs and compliance under the illicit discharge detection and elimination (IDDE) part of the municipal stormwater permits.

## Feedback Workshops

Two workshops were held to obtain feedback from municipal stormwater staff about their usage of the IC-ID Manual, suggestions for updates or improvements to the document, and new or customized field methods that could be incorporated into the updated version.

## Goals and Objectives

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Two goals and three objectives were identified for the feedback workshops.

Goals:

1. Obtain input and feedback from municipal employees on the 2013 IC-ID Manual.
2. Gather information on municipal NPDES permittees' interpretations and approaches for IDDE programs.

Objectives:

1. Facilitate a guided discussion of the 2013 IC-ID Manual with workshop participants.
2. Identify IC-ID methodologies and indicators used by permittees.
3. Identify, as possible, IC-ID methodologies and indicators not used by jurisdictions and why.

## Planning and Advertising

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The workshops were scheduled for February 4 and February 25 in Seattle and Everett, respectively. However, the February 4 workshop was rescheduled due to winter weather that made travel difficult. The rescheduled workshop was held on March 4 at the same location in Seattle as planned.

The workshops were advertised widely to encourage attendance. An announcement was sent out via the distribution list noted in Table 1, which represent the administrators of list-serves or email groups. An online attendance tracker (Brown Paper Tickets) was used to obtain RSVPs and communicate with workshop attendees. Follow-up messages were sent to those who had RSVP'd as reminders prior to each workshop and about the rescheduled February 4 workshop. In addition, the workshop announcement was posted on Ecology's SAM webpage and on the Washington Stormwater Center's website.

**Table 1. Workshop and survey announcement distribution list**

Name of Group	Contact Name(s)	E-mail
Stormwater Action Monitoring (SAM)	Brandi Lubliner	brandi.lubliner@ecy.wa.gov
Stormwater Work Group (SWG)	Karen Dinicola	karen.dinicola@ecy.wa.gov
Ecology's WWA stormwater listserv	Abbey Stockwell	abbey.stockwell@ecy.wa.gov
Ecology's EWA stormwater listserv	Abbey Stockwell	abbey.stockwell@ecy.wa.gov
Ecology's regional municipal stormwater permit coordinators	Christina Maginnis Angela Vincent Rian Sallee Colleen Crotty Danielle DeVoe Ray Latham Chad Atkins	christina.maginnis@ecy.wa.gov angela.vincent@ecy.wa.gov rian.sallee@ecy.wa.gov colleen.crotty@ecy.wa.gov danielle.devoe@ecy.wa.gov ray.latham@ecy.wa.gov chad.atkins@ecy.wa.gov
NPDES Permit Coordinators Group	Don Robinett	drobinett@ci.seatac.wa.us
APWA Stormwater Committee	Paul Fendt, Maureen Meehan	PFendt@parametrix.com; mmeehan@co.pierce.wa.us
Washington Stormwater Center	Laurie Larson	laurie.larson-pugh@wsu.edu

## Agenda and Curriculum

The agenda for the workshops is provided below, which is the outline of the curriculum. The curriculum itself is provided in Appendix A, which includes the presentation slides used during the workshops and the worksheets that were completed by participants.

### WORKSHOPS AGENDA

1. Introduction and Background (15 minutes)
  - Round the room introductions: name, agency, role in IDDE work
  - Agenda and logistics
  - What is the 2013 IC-ID Manual?
  - Why it's being updated now
  - Objectives of current project: update manual, provide trainings
2. Your jurisdiction's approach: how would you screen for and identify these illicit discharges? (35 minutes)



- Participants use their typical methods. Five examples.
    1. Presence of discharge (go through first one together)
    2. Sudsy/foamy water
    3. Unnaturally colored discharge
    4. Rotten egg smell
    5. Algae bloom
  - Hand out flow charts from Manual and go through exercises comparing jurisdictions' approaches to Manual. Different outcomes?
  - Collect completed worksheets
3. Methodology and Indicator Review from IC-ID Manual (100 minutes)
- Hand out copies of Manual (2-3 people share). Printed copies of Manual chapters 2, 3, and 4.
  - Go methodology by methodology (indicator by indicator)
    - 6 Field screening methodologies (+ 3 others)
    - 15 Indicators (+ 18 others)
    - 10 Source tracing methodologies (+ 5 others)
  - For each methodology/indicator:
    - Write questions on white board or flip chart on easel: who uses it, impediments to using, and suggested improvements.
    - Rapid fire approach: approx. 2-3 minutes each with 1 slide each.
    - May need to prioritize or skip some to get through them all.
  - Open discussion of suggestions for other field screening methodologies, indicators, or source tracing methodologies not covered in the Manual.
4. Collecting IDDE Data (20 minutes)
- How are data collected in the field?
    - Paper forms? Electronic forms? Photos?
    - Preferences for improved note-taking?
  - What happens to data back at the office?
    - What is process for storing data?
    - What databases are being used?
  - IDDE trainings
    - At upcoming Municipal Stormwater Conference, Apr 24 in Sea-Tac. Repeat of 2013 training.
    - Trainings on updated Manual in late 2019 and early 2020
    - Preferred locations for trainings
    - Videos
5. Wrap-Up and Next Steps
- Project contact information

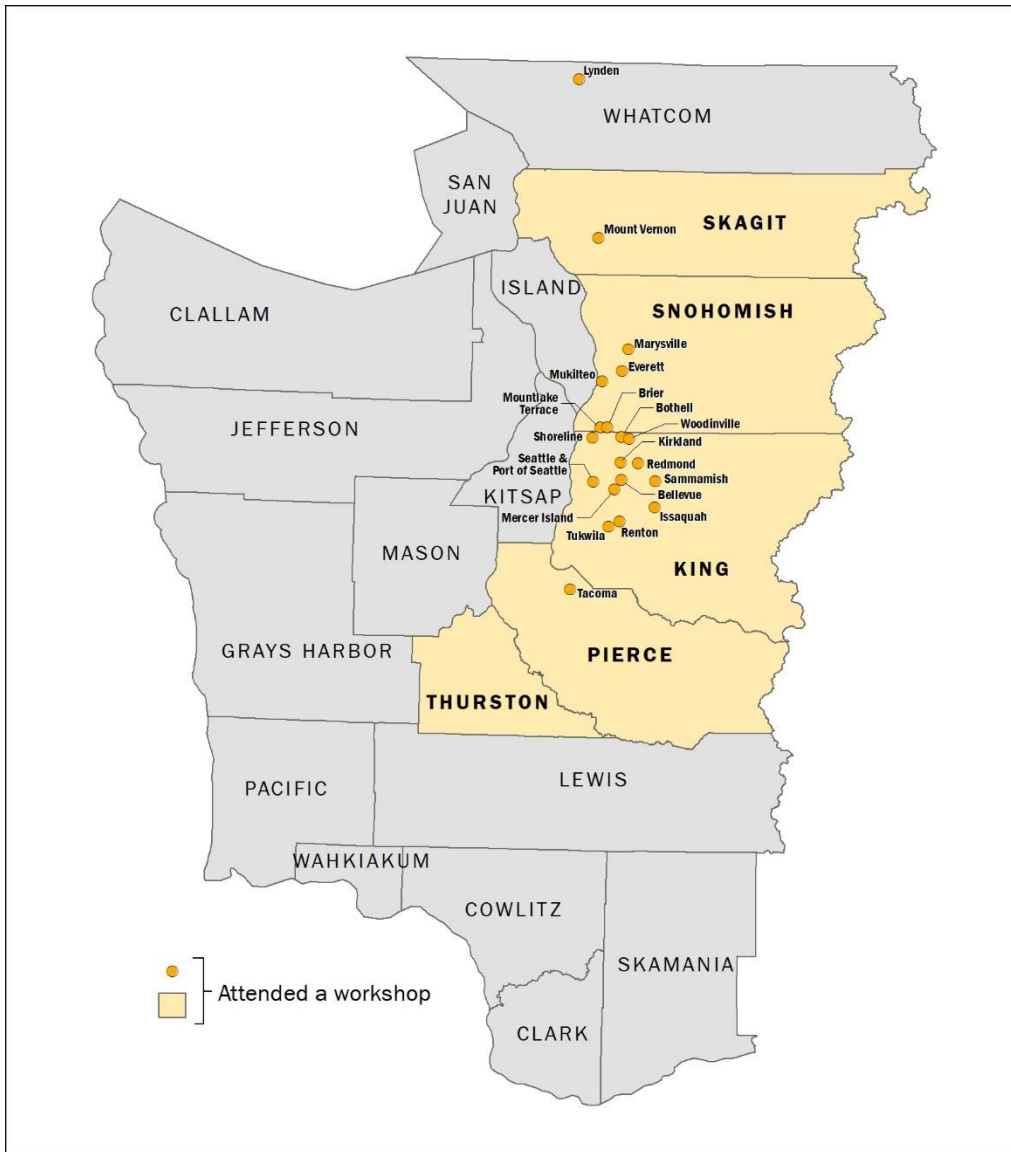
## Results

The number of attendees at the two workshops and the jurisdictions they represent are provided in Table 2. A total of 47 attendees participated in the workshops, which is less than half of the number of RSVPs received (51 for the first workshop and 57 for the second). The attendance sheets from the workshop are included in Appendix A.

**Table 2. Workshop participation.**

	<b>Workshop 1 2/25/19</b>	<b>Workshop 2 3/4/19</b>	<b>Jurisdictions Represented</b>
Cities	20	14	Bellevue, Bothell, Brier, Everett, Issaquah, Kirkland, Lynden, Marysville, Mercer Island, Mount Lake Terrace, Mount Vernon, Mukilteo, Redmond, Renton, Sammamish, Seattle, Shoreline, Tacoma, Tukwila, Woodinville
Counties	8	3	King, Pierce, Skagit, Snohomish, Thurston
Ports		1	Seattle
Other	1		consultant

The locations of the attendees were from throughout western Washington, though by no means representative of all municipal stormwater permittees. Figure 1 shows the jurisdictions (cities, counties, and ports) across western Washington that were represented by attendance at either workshop.



**Figure 1. Jurisdictions Represented by Workshop Attendance**

The feedback received during the workshops is summarized in the sections below, which follow the main agenda items. In addition to the feedback directly received at the workshops, individuals from three jurisdictions (City of Renton, Snohomish County, and Thurston County) provided feedback by completing the workshop worksheets and sending them in. All feedback received is summarized together below.

**Your Jurisdiction’s Approach Exercise**

This exercise helped participants articulate how they would identify various illicit discharges, including presence/absence, foamy, unnaturally colored, rotten egg smell, and algae bloom. Participants were asked how their jurisdiction would field screen, identify, and trace the source of these discharges. The exercise also served as a warm-up for the next part of the workshop by comparing answers from the exercise to the IC-ID Manual.

During the workshops, the separation of the stages of screening, identifying, and tracing illicit discharges was emphasized to follow the 2013 IC-ID Manual. Some participants’ responses were consistent with the approaches in the IC-ID Manual and other answers were offered, too. Participant responses to the exercise are provided in Table 3. Some answers from participants crossed among these categories, for example using an indicator test for field screening. The practical usefulness of the separation of these three stages was discussed with participants, and it was acknowledged that sometimes it’s not necessary to first screen, then test, and finally source-trace. Rather, it can be more efficient sometimes to pursue these stages simultaneously or to skip the screening or indicator testing stages and proceed directly to identify the source of the discharge.

**Table 3. Workshop responses for the Your Jurisdiction’s Approach exercise**

Illicit Discharge Example	Screening	Identification	Tracing
	Participant Responses	Participant Responses	Participant Responses
1. Presence of discharge	<ul style="list-style-type: none"> <li>• O&amp;M field crews</li> <li>• Map review</li> <li>• Outfall inspection</li> <li>• CB/MH inspection</li> <li>• Business inspection</li> <li>• Source control</li> <li>• Citizen complaint</li> <li>• Dry weather inspection</li> <li>• Check construction permits</li> </ul>	<ul style="list-style-type: none"> <li>• Fluoride measurement</li> <li>• pH measurement</li> <li>• Bacteria test</li> <li>• Chlorine</li> <li>• Visual indicators</li> <li>• Odor indicators</li> <li>• Surfactants test</li> </ul>	<ul style="list-style-type: none"> <li>• Dye test</li> <li>• Smoke test</li> <li>• Follow discharge</li> <li>• Use GIS/map to review drainage area</li> <li>• Check permits</li> <li>• Contact property owners</li> <li>• Drive-by survey</li> <li>• Water sampling</li> <li>• CCTV</li> </ul>
2. Sudsy or foamy discharge	<ul style="list-style-type: none"> <li>• Outfall inspection</li> <li>• CB/MH inspection</li> <li>• Stream surveys</li> <li>• Hotline call</li> <li>• BMP inspection</li> <li>• Water sampling</li> <li>• Land-use review</li> </ul>	<ul style="list-style-type: none"> <li>• Scent</li> <li>• Surfactant test</li> <li>• Land use</li> <li>• Bacteria test</li> <li>• Temperature measurement</li> <li>• Observe surroundings</li> <li>• Contact fire department</li> </ul>	<ul style="list-style-type: none"> <li>• Land use</li> <li>• Reconnaissance by vehicle or walking</li> <li>• Smoke test</li> <li>• Dye test</li> <li>• CCTV</li> <li>• Review system maps</li> <li>• Follow known hot-spots</li> </ul>
3. Unnaturally colored discharge	<ul style="list-style-type: none"> <li>• Ditch inspection</li> <li>• Scent/odor</li> <li>• Local recon</li> <li>• Business inspection</li> <li>• Field crew</li> <li>• Hotline call, complaint</li> <li>• CB/MH inspection</li> <li>• System cleaning</li> </ul>	<ul style="list-style-type: none"> <li>• pH measurement</li> <li>• Hardness measurement</li> <li>• Reconnaissance</li> <li>• BMP inspection</li> <li>• Soil samples</li> <li>• Alkalinity test</li> </ul>	<ul style="list-style-type: none"> <li>• Land use</li> <li>• Dye test</li> <li>• Smoke test</li> <li>• CCTV</li> <li>• Map/GIS review</li> <li>• Walking recon</li> <li>• Use institutional knowledge</li> </ul>

Illicit Discharge Example	Screening	Identification	Tracing
	Participant Responses	Participant Responses	Participant Responses
4. Rotten egg smell	<ul style="list-style-type: none"> <li>• Citizen complaint</li> <li>• CB/MH inspection</li> <li>• Check for dead animals</li> <li>• Odor or visual signs</li> </ul>	<ul style="list-style-type: none"> <li>• Hydrogen sulfide measurement</li> <li>• Bacteria test</li> <li>• pH measurement</li> <li>• Sulfur test</li> <li>• Dye test</li> <li>• Dissolved oxygen test</li> <li>• Visual or odor signs</li> </ul>	<ul style="list-style-type: none"> <li>• Look for signs of dumping</li> <li>• Check for natural gas leak</li> <li>• Follow pipe upstream</li> <li>• Check map/GIS</li> <li>• Business inspection</li> <li>• Dye test</li> <li>• CCTV</li> </ul>
5. Algae bloom	<ul style="list-style-type: none"> <li>• Citizen Complaint</li> <li>• Visual observation</li> <li>• Temperature measurement</li> <li>• Survey beach-goers</li> <li>• Monitor outfall</li> <li>• Identify landscapers working in area</li> <li>• BMP inspection</li> </ul>	<ul style="list-style-type: none"> <li>• Nutrients measurement</li> <li>• Sample bird waste</li> <li>• Bacteria test</li> <li>• Conductivity test</li> <li>• Temperature measurement</li> <li>• Check for pet waste</li> <li>• Potassium test</li> <li>• Detergent test</li> </ul>	<ul style="list-style-type: none"> <li>• Sample outfall</li> <li>• Upstream land use</li> <li>• Search for septic tanks</li> <li>• Seasonal monitoring</li> <li>• Monitor circulation of water</li> <li>• Map/GIS review</li> <li>• Areas of high fertilizing (golf course)</li> </ul>

## Manual Sections Review

Following the Your Jurisdiction’s Approach Exercise, the three major sections of the IC-ID Manual were reviewed with the participants to obtain their feedback on the specifics of the Manual. These sections included the chapters on field screening methodologies, indicators, and source tracing methodologies. The results from the workshops are provided in tables at the end of this document due to their size.

### Field Screening Methodologies

Participants were asked to indicate their use of the five primary field screening methodologies in the 2013 IC-ID Manual. In addition to the five primary field screening methodologies, the Manual includes brief mention of three other methodologies that are less commonly used. Participant responses are provided in Table 4.

### Indicators

Participants were asked to indicate their use of the indicator tests in the 2013 IC-ID Manual. There are 16 main indicators included in the IC-ID Manual and 20 additional indicators mentioned briefly that are less commonly used. Participant responses are provided in Table 5.

### Source Tracing Methodologies

Participants were asked to indicate their use of the source tracing methodologies in the 2013 IC-ID Manual. There are 6 main source tracing methodologies included in the IC-ID Manual and 5 additional ones mentioned briefly that are less commonly used. Participant responses are provided in Table 6.

**Table 4. Workshop responses for field screening methodologies**

<b>Methodology</b>	<b>Usage Count</b>	<b>Impediments</b>	<b>Improvements</b>	<b>Comments</b>
Business Inspections	15		<ul style="list-style-type: none"> <li>• Access to private property</li> <li>• Flexibility to work with other agencies collaboratively</li> <li>• Would like to get credit</li> </ul>	<ul style="list-style-type: none"> <li>• Snohomish County has adopted this manual</li> </ul>
Catch Basin/Manhole Inspections	30	<ul style="list-style-type: none"> <li>• Labor intensive</li> <li>• Short dry weather season</li> <li>• Rapid documentation</li> <li>• Health &amp; safety (traffic control, confined space)</li> <li>• Staffing costs</li> <li>• Only visual survey, no sample</li> <li>• Cost</li> <li>• Groundwater effects</li> </ul>		
Ditch Inspections	17	<ul style="list-style-type: none"> <li>• Heavy vegetation</li> <li>• Labor intensive</li> <li>• Health &amp; Safety</li> <li>• Make sure ditch not a channelized stream</li> <li>• Training (groundwater inundation)</li> <li>• 404 vs. 402 due to regulation reclassification</li> <li>1. Regulations for state level designation of the water groundwater flow</li> </ul>	<ul style="list-style-type: none"> <li>• Distinguish between groundwater and surface water</li> <li>• Consider irrigation ditches that may carry drainage</li> </ul>	
Outfall Screening	22	<ul style="list-style-type: none"> <li>• Property access</li> <li>• Dilution</li> <li>• Labor intensive</li> <li>• Submerged outfall (go to next CB upstream)</li> <li>• Fish passable culverts</li> <li>• Tidal influence</li> <li>• Weather</li> </ul>		

Methodology	Usage Count	Impediments	Improvements	Comments
Stormwater BMP Inspections	23	<ul style="list-style-type: none"> <li>• Municipal vs. private</li> <li>• Access</li> <li>• Safety concerns</li> <li>• Need BMP plans to assess</li> <li>• Age of facility/as-builts</li> </ul>		
Video Inspections	14	<ul style="list-style-type: none"> <li>• Time-consuming</li> <li>• Expensive</li> <li>• Equipment</li> <li>• Blockages/root intrusion</li> <li>• Black and white cameras / quality of video</li> <li>• Trained crew</li> <li>• Time to review video</li> <li>• Secondary goal to condition assessment</li> </ul>		
Other: Automated Sampling	2			<ul style="list-style-type: none"> <li>• Would like Salmon Safe information added (Shoreline)</li> <li>• Interested in learning more</li> <li>• Valuable (Snohomish County)</li> </ul>
Other: Intensive Sampling	4			<ul style="list-style-type: none"> <li>• Two jurisdictions are Interested in learning more to see if it's useful</li> </ul>
Other: Sediment Trap Sampling	2			<ul style="list-style-type: none"> <li>• Use macro-invertebrates to identify steam impacts</li> <li>• Useful in industrial areas, but used in residential too</li> <li>• Need to learn more about sed trap use</li> </ul>

**Table 5. Workshop responses for indicator testing**

Indicator	Usage Count	Impediments	Improvements	Comments
Flow	30	<ul style="list-style-type: none"> <li>• Access: depth of CB's</li> <li>• Groundwater input</li> <li>• Doesn't anyways indicate IDDE</li> <li>• Allowable flows</li> <li>• Access</li> <li>• Low flows/intermittent flows</li> </ul>		
Ammonia	11	<ul style="list-style-type: none"> <li>• Using colorimetric strips has poor resolution</li> </ul>		<ul style="list-style-type: none"> <li>• KC dropped using an ammonium ion probe</li> <li>• Using strips, analytical test, lab</li> </ul>
Color	26	<ul style="list-style-type: none"> <li>• Color blind</li> <li>• Shading/differences in color</li> <li>• Depth of structure &amp; light source</li> <li>• Duration of color</li> </ul>	<ul style="list-style-type: none"> <li>• Pulling up samples for close up inspection, rather than looking down into deep infrastructure</li> </ul>	
Odor	31	<ul style="list-style-type: none"> <li>• Subjectivity / poor sense of smell</li> <li>• Residual odors</li> <li>• Ambient odor</li> <li>• Hazardous/toxic odors</li> <li>• Actual location may be different</li> </ul>		
pH	27	<ul style="list-style-type: none"> <li>• Calibrating field meters</li> <li>• Color blind of test strips</li> <li>• Shelf life of test strips</li> </ul>		<ul style="list-style-type: none"> <li>• Field meters or test strips more commonly used</li> <li>• Mercer Island sends out to lab</li> <li>• Best done in field (not lab)</li> </ul>
Temperature	23			<ul style="list-style-type: none"> <li>• Use mix of data logger, field meter, and thermometer</li> <li>• This method is best done in the field and is cost effective</li> </ul>
Turbidity	26	<ul style="list-style-type: none"> <li>• Natural cause</li> <li>• Meter calibration</li> <li>• Differing opinions on viewing site tube</li> <li>• Sampling vs. Receiving water</li> </ul>		<ul style="list-style-type: none"> <li>• Use mix of meter and visual observation</li> <li>• This method is best done in the field and is cost effective</li> </ul>



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Indicator	Usage Count	Impediments	Improvements	Comments
Visual Indicators	33	<ul style="list-style-type: none"> <li>• Can be misinterpreted</li> <li>• Trained staff</li> <li>• Subjectivity</li> </ul>		
Chlorine	12	<ul style="list-style-type: none"> <li>• Volatile</li> <li>• Doesn't last long</li> <li>• Water line leaks may not always be confirmed with this indicator</li> </ul>		<ul style="list-style-type: none"> <li>• Use mix of lab and test kits</li> </ul>
Detergents, Surfactants	17	<ul style="list-style-type: none"> <li>• Hazardous waste disposal from test kit</li> </ul>	<ul style="list-style-type: none"> <li>• Consider some urgency behind this</li> </ul>	<ul style="list-style-type: none"> <li>• Use mix of lab (mostly) and test kits</li> </ul>
Fecal Coliform	32	<ul style="list-style-type: none"> <li>• Bark or mulch can trigger (Kenmore)</li> <li>• Sample hold time and time to produce</li> <li>• Honing in on a source after results</li> <li>• Wet weather vs. Dry weather</li> </ul>		<ul style="list-style-type: none"> <li>• <i>E. coli</i> is now the WQ standard, but do not want this to be excluded</li> </ul>
Fluoride	9	<ul style="list-style-type: none"> <li>• Need to know your water supply</li> <li>• Quality and cost-effective tool / meter calibration</li> <li>• If trigger value is set too low, can be chasing</li> </ul>		<ul style="list-style-type: none"> <li>• Use mix of field meter and lab</li> </ul>
Hardness	8	<ul style="list-style-type: none"> <li>• Knowing the background levels</li> </ul>	<ul style="list-style-type: none"> <li>• Should mention hardness correction for metals analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Use test strips, lab, and chemical testing</li> </ul>
Nitrate	7	<ul style="list-style-type: none"> <li>• Cost to calibrate the probe</li> </ul>		<ul style="list-style-type: none"> <li>• Use test strips and lab</li> </ul>
Potassium	4	<ul style="list-style-type: none"> <li>• Lab method</li> <li>• Excessive nutrients</li> </ul>		<ul style="list-style-type: none"> <li>• Use lab and ammonium/potassium ratio</li> </ul>
Specific Conductivity	11			<ul style="list-style-type: none"> <li>• Use mix of field meter and lab</li> <li>• This method is best done in the field and is cost effective</li> </ul>
Other: Alkalinity	0			
Other: Bacteroides	3			

Indicator	Usage Count	Impediments	Improvements	Comments
Other: Biochemical Oxygen Demand	2			
Other: Boron	0			
Other: Dissolved Oxygen	7			
Other: <i>E. coli</i>	6			
Other: Enterococcus Bacteria	2			
Other: Glycol	0			
Other: Metals	4		<ul style="list-style-type: none"> <li>• Should mention hardness correction for metals analysis</li> </ul>	
Other: Orthophosphate	3			
Other: Phenol	0			
Other: Phosphate	1			
Other: SVOCs	3			
Other: Tannins and Liggins	0			
Other: Total Dissolved Solids	0			
Other: Total Kjeldahl Nitrogen	2			

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Indicator	Usage Count	Impediments	Improvements	Comments
Other: Total Petroleum Hydrocarbons	7			<ul style="list-style-type: none"> <li>• Renton would like to see added</li> <li>• A visible sheen is a state water quality threshold</li> </ul>
Other: Toxicity Screening Tests	0			
Other: Caffeine	2			
Other: Cholesterol	1			

**Table 6. Workshop responses for source tracing methodologies**

Methodology	Usage Count	Impediments	Improvements	Comments
Dye Testing	22	<ul style="list-style-type: none"> <li>• Permission</li> <li>• Absorbed by soil</li> <li>• Having enough water</li> <li>• Slow</li> <li>• People have to be home</li> <li>• Some colors will last very long</li> <li>• Notify neighboring jurisdictions</li> </ul>		
Optical Brightener	6	<ul style="list-style-type: none"> <li>• Time-consuming</li> <li>• Low to no results</li> <li>• Hard to see</li> <li>• Performed by another department</li> </ul>		
Sand-bagging	1	<ul style="list-style-type: none"> <li>• Remember to remove</li> </ul>		
Septic System Inspections	9	<ul style="list-style-type: none"> <li>• Coordination with other dept.</li> <li>• Overworked staff</li> <li>• Access</li> </ul>		
Smoke Testing	5	<ul style="list-style-type: none"> <li>• Public notification</li> <li>• Traffic control</li> <li>• Labor intensive</li> </ul>		
Vehicle/foot Reconnaissance	31	<ul style="list-style-type: none"> <li>• Property access</li> </ul>		
Other: Color Infrared Aerial Photography	0			
Other: Continuous Temperature Monitoring	2			
Other: Homeowner/Property Interviews	15		<ul style="list-style-type: none"> <li>• Add a questionnaire</li> <li>• Should be added</li> </ul>	
Other: Infrared Thermography	1		<ul style="list-style-type: none"> <li>• Snohomish Co. would like to see this added.</li> </ul>	
Other: Stream Walks	16	<ul style="list-style-type: none"> <li>• Access</li> </ul>		<ul style="list-style-type: none"> <li>• Section is pretty straightforward</li> </ul>

### Collecting IDDE Data

Participants were queried about what data collection and storage methods they use. While data collection is not a topic covered in the 2013 IC-ID Manual, some basic information about how data are collected and managed were deemed useful to understand for the update to the Manual. A summary of participant responses about data collection is provided in Table 7 and Table 8 below. Usage count data are relative to the number of participants among both workshops.

**Table 7. Workshop responses for data collection methods**

Method	Usage Count	Comments
Paper forms	17	
Digital forms	16	<ul style="list-style-type: none"> <li>• Customizable app with tablet or phone</li> <li>• Dictated by department</li> <li>• Not easy to generate or use a new form</li> </ul>
Photos / Videos	28	<ul style="list-style-type: none"> <li>• Many not currently organized or being managed</li> <li>• Taken with a GPS enabled device (Tukwilla)</li> <li>• Using SharePoint folders (Port of Seattle)</li> <li>• Video is sometimes limited to the manufacturer's proprietary software</li> <li>• Good mapping systems can help overcome video limitations</li> </ul>
Additional comments		<ul style="list-style-type: none"> <li>• Best to minimize free form text and instead use check boxes or drop-down menus</li> <li>• Need to incorporate software-enabled photo linking</li> <li>• Use of placards can be helpful</li> </ul>

**Table 8. Workshop responses for software used to manage data**

Software Used	Usage Count
CityWorks or other asset management software	23
MS Access, spreadsheet, or custom database	12

### Training Locations

Workshop participants were asked their preferences for locations for the upcoming training workshops planned for after the publication of the updated IC-ID Manual. Counts of participants were taken for both preferred and reasonably possible locations where they could attend a training (Table 9). The locations are grouped into regions throughout Puget Sound and one non-Puget Sound location (Vancouver, Washington). The highest counts within each region are highlighted in Table 9. This information will be used to for deciding locations for the eight trainings on the IC-ID Manual.

**Table 9. Workshop responses for training locations preferences**

Region	General Location	Possible to Attend	Preferred Location
North Sound	Bellingham	11	4
	Mt. Vernon	15	5
Central Sound	Bellevue	33	5
	Bothell	7	3
	Everett	30	13
	Redmond	32	12
	Renton	25	3
	Seattle	27	9
South Sound	Olympia	6	0
	Puyallup	15	3
	Tacoma	11	3
West Sound	Poulsbo	1	0
Non-Puget Sound	Vancouver	0	0

Notes: Highest count  
2<sup>nd</sup> highest count

The locations with the highest count that workshops attendees indicated were possible for them to attend are Bellevue, Everett, Redmond, and Seattle. The second most possible locations were Puyallup, Renton, and Tacoma.

## Workshop Outcomes to Consider For the IC-ID Manual Update

The workshop feedback provided some helpful ideas and comments on potential updates to the IC-ID Manual. These include:

- In some situations, it can be more efficient to skip the screening or indicator testing stages and go directly to tracing the source of the illicit discharge. The flow charts could be revised to provide more direct pathways to identifying discharge sources and criteria to know when it's appropriate to do so.
- Add discussion of allowable discharges to Manual.

## ASPECT CONSULTING

- The Manual is large and detailed and can be intimidating to use. It would help to add some navigation tools, such as an index.
- Ditch inspections section needs to be beefed up to distinguish between stream and creek and how to identify illicit discharges from base flow or irrigation water.
- For BMP inspections, obtain as-built plans, if possible, to evaluate if system is working properly.
- As part of the screening stage, check the active construction permits in the area
- As part of indicator testing stage, review any lab results for vector waste from the area if available
- Other indicators to consider adding or revising:
  - Caffeine
  - Move *E. coli* bacteria up to be a primary indicator (rather than alternative)
  - Combinations of: caffeine and fecal coliform bacteria, caffeine and cholesterol
  - Aquatic macroinvertebrates
  - Expand discussion of automated sampling to include new technology
  - Expand discussion of sediment trap sampling
  - Color test strips should be less prioritized as they are low resolution
  - For color determination, the depth of discharge, light source, and shading should be considered. Best to pull sample in glass container and evaluate in daylight.
  - Add natural gas and dead animals as an indicator for odorous discharges
  - Ammonium probe not useful
  - Visual indicators should be verified by other staff due to subjectivity
  - Surfactants test kits (vials, bulk liquids generated) require special disposal
  - Need to know background levels when measuring:
    - Turbidity
    - Fluoride
    - Hardness
  - For metals measurement, include correction factors based on hardness.
  - Add test for total petroleum hydrocarbons.
- For sand-bagging, add reminder to remove sand bags when finished.
- Expand dye testing description to include time to run test and neighborhood notification.

- Dye testing and smoke testing are labor-intensive and may require significant traffic control.
- Create a sample questionnaire for homeowner/property owner interviews.
- Add infrared thermography as a source tracing option.

## Survey

A 10-question survey developed in Survey Monkey was distributed in December 2018 to the same distribution list as the workshop. A total of 35 responses were received. Responses to each of the survey questions are summarized below.

### **Question 1. Which method(s) does your jurisdiction/ organization currently use to screen for illicit connections (ICs) and illicit discharges (IDs)?**

Table 10 provides the number of responses to question one. Among the eight field screening methodologies, four of them are used by more than half of the 35 respondents. The top two were dry weather inspections of catch basins and manholes and any weather inspections of stormwater BMPs, which were used by over 80 percent of respondents. Next most commonly used by more than half of respondents were dry weather inspections of outfalls and ditches (71 percent and 60 percent, respectively) and business inspections (54 percent). Less than half of respondents indicated use of CCTV inspections, vehicle reconnaissance, and sampling.

Eight respondents provided additional comments. The comments included clarifying statements about inspecting both private and public catch basins and manholes and interlocal agreements to accomplish inspections. In addition, one respondent noted the use of Coliscan© Easygel© test for fecal coliform bacteria (one of the indicators covered in question 3 below).

**Table 10. Responses to Survey Question 1: Field Screening Methodologies**

<b>Field Screening Methodology</b>	<b>Number of responses</b>	<b>Percent of responses</b>
Catch basin/manhole inspections, dry weather	29	83%
Stormwater BMP inspections, any weather	29	83%
Outfall inspections, dry weather	25	71%
Ditch inspections, dry weather	21	60%
Business inspections, any weather	19	54%
CCTV inspections of closed stormwater conveyances, any weather	16	46%



Field Screening Methodology	Number of responses	Percent of responses
Vehicle reconnaissance, large scale, any weather	16	46%
Sampling water or sediments, in MS4 or natural waters, any weather	13	37%
Other (please specify)	8	23%

Notes: Removed duplicate survey response (#17 and #20 both came from the City of Battleground and had duplicate answers)

Responses provided for *Other (please specify)* answer option:

- Both public and private catch basin and manhole inspections visually screen for ID/IC concerns. In general, effective stormwater inspections can be complicated by moderated to heavy precipitation, but I don't believe a misty shower or the like would necessarily prevent inspections from taking place.
- ILA with County to perform inspections annually
- Outfall inspections are only in the dry season.
- Catch basin inspections - Any weather Outfall Inspections - Any weather
- Dry Weather business inspections, off-hour, completed when businesses are typically cleaning up from the day's activities, but City Staff are not available.
- We may also use other means to screen for IC-ID, but typically in response to complaint follow-up as opposed to our programmatic screening approach, which is just to perform outfall inspections during dry weather.
- Other more intensive field screening per watershed (more involved than vehicle reconnaissance).
- For water quality screening for bacterial levels, we use the affordable Coliscan Easygel test, related to IC-ID detection work in our fecal coliform total maximum daily load (FC TMDL) projects.

**Question 2. Which method(s) does your jurisdiction/ organization currently use to trace the sources of ICs and IDs?**

Table 11 summarizes the responses regarding current source tracing methodologies (Question 2 of the survey). The top three methodologies used by jurisdictions to trace the sources of ICs and IDs include catch basin/manhole inspections (91 percent), presence of flow in dry weather (89 percent), and dye testing (visual dye method) (80 percent). Three methodologies tied at 71 percent and included ditch inspections, sample collection, and foot reconnaissance. Business inspections and CCTV inspections are the next most commonly used methodologies at just over 50 percent of respondents.

Seven respondents provided additional comments related to specific methodologies, including temperature loggers and surfactant testing. Other respondents referred to methodologies for targeted septic tracing efforts.

**Table 11. Responses to Survey Question 2: Source Tracing Methodologies**

Source Tracing Methodologies	Number of responses	Percent of responses
Catch basin/manhole inspections	32	91%
Presence of flow in dry weather	31	89%
Dye testing, visual dye method	28	80%
Ditch inspections	25	71%
Sample collection for lab analyses (bacterial, petroleum products, etc.)	25	71%
Foot reconnaissance, small scale	25	71%
Business inspections	19	54%
CCTV inspections of closed stormwater conveyances	19	54%
Smoke testing	10	29%
Other (please specify)	7	20%
Septic system inspections	6	17%
Dye testing, charcoal packet method	5	14%
Optical brightener monitoring	5	14%
Sand bagging	1	3%

Notes: Removed duplicate survey response (#17 and #20 both came from the City of Battleground and had duplicate answers)

Responses provided for *Other (please specify)*:

- Have used Onset pendant temperature loggers in the past to try to identify anomalous fluctuations.
- ILA with County to perform inspections annually.
- In the past we have also used dye testing and optical brighteners, and may use them again if the situation warrants it.
- Surfactant testing and sampling using MBAS field kit (CHEMetrics K-9400) since most ID/IC's contain a cleaner or wetter that includes surfactants that react to Methylene Blue.
- Additional methods are not currently used, but could be if the situation warranted their use. Septic system testing is done in collaboration with the County Health Department.
- Septic-related tracing efforts (charcoal packets, residential septic inspections) are conducted through collaboration with local Health Department when warranted.

- I would also say we use sample collection for confirmation of sources (e.g., leaking underground heating oil tanks; failing septic systems) - not so much tracing the source, but to confirm what we may "stumble" upon.

**Question 3. Which indicator(s) does your jurisdiction/ organization currently use to screen for and/or trace the sources of ICs and IDs?**

Table 12 summarizes the responses regarding current indicators used for field screening and/or source tracing (Question 3 of the survey). The most commonly used indicators were reported by over 75 percent of the respondents. These top indicators include: visual indicators odor, presence of flow in dry weather, color, and turbidity. The next most commonly used indicator is fecal coliform bacteria (or *E. coli* bacteria) at 60 percent of respondents, followed by pH, temperature, and detergents/ surfactants. All other indicators are used by fewer than 40 percent of respondents; less than 15 percent of respondents reported using hardness, potassium, fluoride, and bacterial DNA (by qPCR technique).

Eight respondents submitted additional replies regarding a variety of other indicators not included on the survey list, including: total suspended solids (TSS), dissolved oxygen, orthophosphate, optical brighteners, heavy metals, copper, calcium, magnesium, lead, and zinc. Several respondents clarified the distinction between indicators used for field screening and inspections versus those used specifically for source tracing, which depend on the investigation and may involve any indicator.

**Table 12. Responses to Survey Question 3: Indicators**

Indicators	Number of responses	Percent of responses
Visual indicators (e.g., abnormal vegetation, deposits and staining, floatables, surface sheen, etc.)	31	89%
Odor	31	89%
Presence of flow in dry weather	30	86%
Color	28	80%
Turbidity	27	77%
Fecal coliform or <i>E.coli</i> bacteria by culture techniques	21	60%
pH	19	54%
Temperature	16	46%
Detergents/surfactants	15	43%
Chlorine	11	31%
Petroleum products analyses, including BTEX, gasoline range and diesel range fractions	11	31%
Ammonia	10	29%

Indicators	Number of responses	Percent of responses
Nitrate	8	23%
Other (please specify)	8	23%
Specific conductivity	7	20%
Hardness	5	14%
Potassium	5	14%
Fluoride	4	11%
Bacterial DNA by qPCR technique	3	9%

Notes: Removed duplicate survey response (#17 and #20 both came from the City of Battleground and had duplicate answers)

Responses provided for *Other (please specify)*:

- Optical brighteners
- Heavy metals, copper, calcium, magnesium, lead, zinc and total suspended solids (TSS)
- Routine public or private system inspections or "screening" are limited to visual indicators or odor concerns. If an issue of concern is identified than any relevant indicator could be utilized to trace the source up system.
- ILA with County to perform inspections annually
- Also used dissolved oxygen, orthophosphate, nitrate+nitrite; In the past we have used most of these indicators at one time or another, and may use any of them in the future. The checked boxes were the indicators that were used the last two summers for an outfall investigation project.
- Floatables
- We may also use other tests, but so far have not had a need for them. We only use these tests for tracing sources, not screening.
- Screening is done by presence of dry weather flow, visual indicators, color, and odor. Depending upon the complexity of the investigation, tracing may involve any of the listed parameter (although we have not actually utilized them all).

#### **Question 4. What needs for screening and source tracing ICs and IDs are currently not being met in your programs, and why?**

The most common response for Question 4 of the survey (as indicated by 12 out of 35 respondents) is related to resource limitations, including constraints associated with equipment, staff availability, and overall funding. Respondents indicated varying levels of satisfaction with their current programs given budget constraints; one respondent

indicated that the current program is more reactive than proactive by necessity, and several indicated that they could not expand their programs or activities without adding staff. Outfall monitoring was listed by multiple respondents as a missing component of their current programs. Respondents also emphasized the need for source control to address widespread pollution, referring to the “never ending” nature of ongoing IDDE efforts.

Two respondents stated that CCTV resources were available at their jurisdiction, but currently prioritized for other programs (specifically sanitary sewer inspections). A few respondents specified that budget for laboratory expenses was an issue that hindered identification (especially for lower level discharges) and source tracing. One respondent stated that mapping and lack of private conveyance system knowledge was an issue. Additionally, one respondent stated that one difficulty was discerning groundwater inflow during dry weather field screening (wet weather field screening was identified as a need).

Full responses are included below:

- Limited resources are either working to eliminate active illicit discharges, following up with prior discharges in order try and prevent them in future, or handling activities related to enforcement or code compliance. Eliminating illicit discharges and source control issues related to fixed and mobile businesses is never ending. The need is for a much greater emphasis on overall Source Control in ALL forms. Eliminating the obvious sources will make it much easier to screen for and trace the "needle in the haystack" sources.
- Not currently conducting outfall inspections due to lack of resources/manpower.
- We are currently performing field screening and inspections as required by the permit. If any further requirements are put in place we would have to reevaluate our needs, which would likely include more staff, testing equipment that fits our need, or funding to support contracting/equipment rental.
- Large sections of private conveyances not documented, no plans or maps of system connectivity.
- We really lack the staff resources to do a more thorough job than we are doing. It is unfortunate because if financial resources weren't so thin, we could accomplish more.
- Lab monitoring of low-level suspected discharges due to budget shortfall and standing requirement to cut programs by 3% annually.
- We need more staff time; current program is more reactive then proactive. Staff time is not allocated due to budget constraints and other NPDES priorities
- We have very limited CCTV resources, can't use them for IDDE.
- Without outfall monitoring, it appears that we are missing IC-ID. When we perform outfall monitoring, we find water quality pollution, but since we do not perform widespread monitoring and instead base that additional monitoring on outfall screening inspection or complaints, we are likely missing a lot of pollution entering receiving waters from our stormwater outfalls. This may not be well received, but the

reality is, without monitoring, we cannot identify areas of concern nor can we effectively prioritize our limited staff time to follow up on IC-ID, which can take a lot of staff time.

- Wet weather field screening. How to discern groundwater inflow during dry weather field screening.
- CCTV inspections, our crew maintains both our sanitary and storm sewer systems. Staffing is prioritized to meet EPA guidelines for capacity management (CMOM) of our sanitary sewer system to prevent overflows.
- It would be super if we had much more staff time and greater lab budgets dedicated to even more screening and source tracing. However, I feel fortunate to be able to do what we're currently doing for screening and source tracing. (The reality of pollution in the MS4 and natural waters is that it's widespread (thousands of car leaks, for example, not to mention trash, excessive fertilizer and pesticide use, etc.) that actually finding every single pollutant source is in the realm of fiction---all we as municipal staff can do is to focus on those items that are Municipal NPDES Permit-mandated, such as IC-ID and FC TMDL, and do our best to shoehorn as much effective IC-IDDE work into those programs as we can.

## Question 5. Which IC-ID guidance manual(s) do you use?

Table 13 provides a summary of the responses to the current guidance used by respondents (Question 5 of the survey). Nearly 70 percent of the respondents are using the *Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual* (King County and WSU, 2013). The next most commonly used manual is *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments* (Center for Watershed Protection 2014).

Seven respondents reported that their jurisdiction uses their own manual or none of the above. Based on respondent descriptions, these approaches involve hybrid or simplified programs, work plans, standard operating procedures (SOPs), and quality assurance project plans (QAPPs) that were developed based on guidance from one of several existing manuals and adjusted to suit the technologies and field practices in place.

**Table 13. Responses to Survey Question 5: Guidance Manuals Used**

Guidance Manual	Number of responses	Percent of responses
Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual (King County and WSU, 2013)	24	69%
Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments prepared by the Center for Watershed Protection (2004 CWP IDDE Manual)	13	37%
Jurisdiction-specific manual	5	14%
None of the above	2	6%

Notes: Removed duplicate survey response (#17 and #20 both came from the City of Battleground and had duplicate answers)

Comments provided:

- We reference the [2013 IC-ID Manual] but mostly use visual screening and then confirm non-compliance with simple methods such as dye testing, fecal coliform testing, pH, turbidity, etc.
- The Port of Seattle has a July 2015 IDDE manual, and primary reference is the [2013 IC-ID Manual].
- Our manual is based on the [2013 IC-ID Manual].
- We also have a QAPP that includes some of the methods.
- [Our] Manual [is] based on the 2004 CWP IDDE Manual.
- We have our own SOP based on the [2013 IC-ID Manual], but we also used the [2004 CWP IDDE Manual] in the development of our SOP.
- For flexibility, we use a hybrid approach using what we think is good guidance from both manuals.
- We have program-specific work plans (sampling & analysis plans) for our fecal coliform total maximum daily load (FC TMDL) projects that are basically IC-ID-oriented. Our plans were originally based on both the [2004 CWP IDDE Manual] and the 2013 IC-ID Manual; over time, we've adjusted our approaches, due to increasing experience with the Coliscan Easygel method and also lab testing, both for bacteria culturing and qPCR (DNA) analysis.

## **Question 6. If you use the 2013 IC-ID Manual, which sections of the IC-ID Guidance Manual are useful?**

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Table 14 summarizes the responses to the usefulness of the 2013 IC-ID Manual (Question 6 of the survey). The three mostly highly rated “Very Useful” sections of the manual were Section 3.0 – Field Screening Methodologies, Section 4.0 – Indicators, and Section 5.0 – Source Tracing Methodologies. Section 2.0 – Definition and Regulatory Requirements was categorized as “Moderately Useful” by 10 of the 25 respondents to this question, whereas Section 1.0 – Introduction and Appendix D – Other Resources were primarily categorized as neutral. Section 1.0, Section 2.0, Appendix A, and Appendix B, and Appendix D were labeled as “Not at All Useful” by 1 to 2 respondents.

Few additional comments were submitted (see below). The most detailed comment requested additional emphasis on compliance enforcement.

**Table 14. Responses to Survey Question 6: Usefulness of IC-ID Manual**

2013 IC-ID Manual Section	Not at all useful	Slightly useful	Neutral	Moderately useful	Very useful	Total
Section 1.0 – Introduction	2	1	11	5	4	23
Section 2.0 – Definition and Regulatory Requirements	1	2	5	10	7	25
Section 3.0 – Field Screening Methodologies	0	1	2	10	12	25
Section 4.0 – Indicators	0	0	3	9	13	25
Section 5.0 – Source Tracing Methodologies	0	0	5	8	11	24
Appendix A – Field Screening, Source Tracing, and Indicator Sampling Equipment Costs	1	4	7	9	4	25
Appendix B – Example Field Forms	2	3	5	8	7	25
Appendix C – Case Studies	0	4	7	8	6	25
Appendix D – Other Resources	2	4	13	2	3	24

Notes: Highest count

Removed duplicate survey response (#17 and #20 both came from the City of Battleground and had

Comments provided:

- Sections 3 and 4 are helpful with the operations staff when out doing field inspections. By standardizing the process, we "speak" the same language.
- We use the 2004 [CWP IDDE Manual].
- The specifics in the [2013 IC-ID Manual] are good but can only set the framework for the investigations. What needs to be covered is not just finding these things, but the regulatory steps to enforce compliance of the rules we all work under. Code enforcement officers at the state level (WACE) has said that ID/IC enforcement is criminal code and not civil code since the law includes Federal Enforcement penalties up to incarceration. These rules need to be rolled out to the newly elected councils, mayors and CITY ADMINISTRATORS that are not willing to listen to staff or read the code and comply.



## Question 7. If you use the 2013 IC-ID Manual, which sections of the IC-ID Guidance Manual need improvement?

Table 15 summarizes the responses to sections of the 2013 IC-ID Manual that need improvement (Question 7 of the survey). The top answer for a section in need of improvement was Field Screening Methodologies (Section 3.0), which was selected by nearly 40 percent of the 19 respondents. Source Tracing Methodologies (Section 5.0) was selected by approximately 20 percent of respondents, followed by the other sections at less than 20 percent. Zero respondents indicated that the Introduction (Section 1.0) needs improvements, and only 5 percent indicated that Appendix B and Appendix C need improvements.

Additional comments were submitted by 14 respondents. Several comments requested improvement related to regulatory content, including updates to permit requirements and elaboration on code enforcement procedures. Other comments were focused on field strategies and increased customization/flexibility for the jurisdiction’s unique needs, including: recommendations on level of investment and prioritization for smaller jurisdictions with limited funding, updates to equipment pricing, updates on new screening methodologies, revising thresholds for further investigation, more photos/visuals, and expanding screening to year-round for all methods. Multiple respondents emphasized that business inspections (“knocking on doors”) and elimination through outreach and education has proved far more effective than field screening or source tracing activities; they would like to shift emphasis to those practices.

**Table 15. Responses to Survey Question 7: Improvements for 2013 Manual.**

2013 IC-ID Manual Section	Number of responses	Percent of responses
Section 1.0 – Introduction	0	0%
Section 2.0 – Definition and Regulatory Requirements	3	16%
Section 3.0 – Field Screening Methodologies	7	37%
Section 4.0 – Indicators	3	16%
Section 5.0 – Source Tracing Methodologies	4	21%
Appendix A – Field Screening, Source Tracing, and Indicator Sampling Equipment Costs	2	11%
Appendix B – Example Field Forms	1	5%
Appendix C – Case Studies	1	5%
Appendix D – Other Resources	0	0%

Notes: Removed duplicate survey response (#17 and #20 both came from the City of Battleground and had duplicate answers)

Comments provided:

- The vast majority of limited resources is used to detect (visual) and eliminate (outreach, education, or enforcement) illicit discharges (and occasionally connections) that did not require the higher-level screening or tracing methodologies presented in the manual.
- Would like more visuals/photos.
- It is adequate.
- Seems to work for us the way it is. We so rarely find IC-ID from screening. Almost everyone is from a business inspection or complaint.
- Updated pricing on equipment [Appendix A].
- Business inspections really needs revamped with all the "Pollution Prevention Assistance" staff out there knocking on doors. The SharePoint site for PPA has a lot more forms, checklists etc.
- I am still new enough I don't feel I can offer a lot of insight.
- We use the 2004 [CWP IDDE Manual].
- Include direction for the code enforcement of the Regulations. What documentation is needed by a CE officer, what notices and how are they served or given to the discharger?
- It would be great to have a "level of investment - recommended approach" section, for those municipalities that are 1-person departments, like my city. For example, if you have good resources, you can do X, but if you have a small budget and limited time, Y is recommended....
- Regulatory requirements will likely need to be updated and could maybe include more on the business inspection part and how that might also meet the IDDE requirements, which is proposed to be a Phase II requirement (in addition to it already being a Phase I requirement).
- Are there new field screening methodologies?
- Are there more lessons learned as jurisdictions have implemented their programs?
- Are there programs that are "really good" at finding/eliminating IC-ID and if so, what methods are they using? What are the biggest risks?
- As small jurisdiction[s] have to prioritize their follow-up activities, are [there] types of land use practices or BMPs that are going to have the greatest impact on improving or maintaining water quality? I would consider thresholds for further investigation that are lower than water quality standards or would be outside of normal background levels (realizing that for some waters/parameters that might be variable). For example, I find it interesting that the [2013 IC-ID Manual] lists the water quality standards for fecal coliform, but thresholds for further investigation are above the standards and the wet weather threshold is significantly higher. Depending on the flow of the outfall and the flow of the receiving waters, these levels could have

significant impact on receiving waters and the water quality standard doesn't distinguish between human and animal sources. Further I would argue that no untreated human waste or non-wildlife animal waste should be allowed to discharge from our MS4 to receiving waters, so without further investigation, how can we ensure that those values are animal related instead of human? What if it is pet waste from a kennel that is washing their waste into the stormwater system? It just seems like we would want to follow-up at a lower level. I understand that fecal coliform is not perfect and that a better indicator may also provide better feedback on what has been found in the field. Maybe provide more of a discussion on when lower thresholds might make sense to be considered? It might make sense to also update the indicator, since the water quality standard has changed?

- Update to reflect changes in permit or regulatory requirements.
- There is value in conducting [field] screening during both dry and wet weather. The option to [field] screen all year should be an option for all methods listed. For example, the [2013 IC-ID Manual] says that Catch Basin/Manhole Inspections should only be performed in dry weather. Also, the [2013 IC-ID Manual] should stress the option for [municipalities] to be able to select methods that fit their needs based upon the specific characteristics of the MS4.

## **Question 8. What additional tools and/or trainings are needed for IC-ID field screening and source tracing?**

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Out of 22 total respondents to Question 8 regarding additional tools and/or trainings, 16 respondents identified gaps. Many respondents emphasized a broad need for more training opportunities/materials and funding for staff time to complete trainings. Specific suggestions include providing hands-on training, offering annual field training at MuniCon and ROADMAP, providing more in-depth training videos, and featuring more field investigation case studies. One respondent stated that the large [2013 IC-ID Manual] was not user-friendly for staff, and that training webinars or reference guides would be beneficial. Another respondent recommended that CWA and Endangered Species Act training should also be provided at the state level to elected officials.

A variety of specific training topics were requested, including up-to-date and affordable field methods/technologies (e.g., DNA sampling for source tracing, charcoal packet dye testing), code enforcement, clarification on Ecology's field screening requirements, and reporting requirements for the 2019 permit.

Out of the six respondents who stated that no additional tools or trainings are needed, two respondents provided comments indicating that their field screening and source tracing experience and training is adequate.

Comments provided:

- Training opportunities and materials.
- Stormwater code enforcement training for Public Works personnel would be helpful.
- More frequent training with a good amount of case studies/photos and how municipalities conducted the investigation.

- It is important to update this manual with and provide trainings on up-to-date, easy, and cheap methodology.
- Would like to see more information on DNA sampling for source tracing, what is involved, costs.
- A webinar or training on the [2013] IC-ID manual - The 280-page document is daunting, and to have it as a useful tool for temporary workers/summer crews would require having usable and easy-to-reference guides.
- Annual field training on the screening and tracing techniques should be offered at MuniCon and ROADMAP.
- I am not entirely sure, but there are instances where primary indicators are positive, and one follow-up indicator is positive, but the issue still cannot be found. Which is frustrating.
- Something will have to be included about the reporting requirements that are in the 2019 permit. The fields and specific data Ecology wants should be in any new IDDE guidance.
- Annual IDDE training for operations personnel and updated, more in-depth training videos.
- Councils, Mayors training at the State Level should include the Clean Water Act and Endangered Species act compliance with direct and specific instruction to those new Phase I and II community leaders.
- We need funding for staff time.
- Hands on training.
- A better understanding of what Ecology actually wants from a screening program, is it number of outfalls or outfalls that represent the MS4? We have many outfalls that we do know their origin and often they are from private property, so also a better understanding of what our obligation is related to private outfalls would be helpful (often these appear to have non-stormwater discharges).
- Screening and tracing training for new staff and refreshers for existing staff.
- Charcoal packet dye testing is a potentially useful tool--I believe Kitsap County has used it a lot for their shellfish protection programs. It's highly labor (time) intensive and typically requires the participation of--and patience & understanding from--private septic system owners. For those reasons, King County Stormwater Services has not used it often. Any tool or training that could possibly increase our ability to deploy charcoal packet dye testing would be appreciated--difficult for me to see how to achieve this. Both our municipal stormwater staff and public health department staff have limited time to do it.

No gaps identified, but provided more detail than listing "none" or "N/A":

- We have been doing this for 20 years.

- I feel that we have adequate experience and training to effectively conduct IC-ID [field] screening and source tracing.

### Question 9. What are the most convenient locations for your jurisdiction for IC-ID training workshops among the following options?

Responses to Question 9 regarding convenient locations for training workshops are summarized in Table 16 grouped by region, including north, central, south, and west Puget Sound as well as Vancouver to represent a non-Puget Sound location. The top four locations (40 percent or more) are Edmonds, Seattle, Bellevue, and Tacoma. The next most convenient locations (20 percent or more) are Redmond, Olympia, and Mount Vernon.

**Table 16. Responses to Survey Question 9: Training Locations**

Region	General Location	Number of Responses	Percent of Responses
North Sound	Bellingham	4	11%
	Mt Vernon	8	23%
Central Sound	Bellevue	14	40%
	Edmonds	15	43%
	Redmond	10	29%
	Seattle	15	43%
West Sound	Bremerton	4	11%
South Sound	Olympia	10	29%
	Tacoma	15	43%
Non-Puget Sound	Vancouver	5	14%

Notes: Highest count  
 2<sup>nd</sup> highest count  
 Removed duplicate survey response (#17 and #20 both came from the City of Battleground and had duplicate answers)

The locations asked about in the survey were slightly different than those asked about in the workshops (see Table 9 above). This occurred because of the project team’s interest in getting feedback on more locations during the workshop, which occurred after the survey. Most locations in the survey were the same as in the workshops with the exception of Edmonds and Bremerton, which were not asked about in the workshop. Instead, Edmonds was replaced by Bothell, Everett, and Renton as central Puget Sound locations; Bremerton was replaced by Poulsbo as a west Puget Sound location; and Puyallup was added as a south Puget Sound location.

## Question 10. Please let us know what jurisdiction/ organization you work for and which County you are located

Survey responses were received from municipal staff representing 33 jurisdictions located in 10 counties in Washington as shown in Figure 2. The list of individuals who filled out the survey and their jurisdictional representation is provided in Appendix B.



**Figure 2. Counties Represented by Survey Responses**

## Survey Responses to Consider For the IC-ID Manual Update

The survey results provide some helpful feedback on potential updates to the IC-ID Manual. These include:

- Incorporating updated permit language related to IDDE reporting and business inspections.
- Clarifying Ecology's field screening requirements.
- Adding new methodologies (e.g., DNA sampling).
- Updating existing methodologies (e.g., charcoal packets [included in the Dye Testing section]).
- Adding new indicators (e.g., *E. coli* bacteria, dissolved oxygen, orthophosphate).
- Updating existing indicators.
- Ranking or prioritizing activities/methodologies/indicators (and follow-up) based on level of investment and what is most effective to help resource-limited jurisdictions implement their programs.
- Creating streamlined reference sheets or field guides/SOPs designed for field crews.
- Adding emphasis on year-round screening rather than dry weather screening.
- Updating field screening, source tracing, and indicator sampling equipment costs (currently included in Appendix A).
- Capturing lessons learned as jurisdictions have implemented their programs since 2013.
- Capturing lessons learned from programs that are "really good" at finding/eliminating IC-ID (e.g., what methods are they using? what are the biggest risks?)

The following were also mentioned for consideration, but are outside the scope of the current manual:

- Increased emphasis on enforcement procedures

# Summary of Workshops and Survey Outcomes

The most relevant outcomes of the feedback workshops and survey are summarized here. The outcomes include comments for updates or improvements to the IC-ID Manual and usage counts of each methodology and indicator. The summary below is grouped into topics relevant to the Manual sections. In addition, the following comments stood out among the feedback on indicators.

As primary type of feedback, usage counts for individual methodologies or indicators are a helpful metric. But a low usage count doesn't necessarily indicate lack of usefulness; rather, usage count feedback should be considered in the context of the methodology or indicator and the discharge being investigated. Some techniques with high usage counts apply to all or most conditions, such as visual reconnaissance. Other techniques with low usage counts may apply only in certain situations, such as automated sampling. The feedback of usage counts and comments will be considered together for what methodologies and indicators may warrant more or less discussion in the IC-ID Manual and how they might be reprioritized.

## Field Screening

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Field screening methodologies with the highest usage count include CB and MH inspections, BMP inspections, dry weather outfall inspections, and ditch inspections, and business inspections. Less commonly used are video inspections and sampling. In addition, the following comments stood out among the feedback on field screening methodologies.

- Add emphasis on year-round screening rather than dry weather screening.
- Expand ditch inspections section. Distinguish between creek and ditch, and between illicit discharges and base flow or irrigation water.
- For BMP inspections, obtain as-built plans to evaluate if system is working properly.
- As part of the screening stage, check the active construction permits in the area

## Indicators

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Indicator tests with the highest usage count include visual observation (presence of flow during dry weather, color, turbidity), odor, bacteria, pH, temperature, and detergents/surfactants. Less commonly used are chlorine, ammonia, conductivity, and petroleum hydrocarbons. Indicators that are the least commonly used include nitrate/nitrite, hardness, potassium, fluoride, and bacteria DNA, *Bacteroidales*, biochemical oxygen demand, dissolved oxygen, and metals. In addition, the following comments stood out among the feedback on indicators.

- Add DNA sampling
- Add *E. coli* bacteria, dissolved oxygen, orthophosphate
- Add Coliscan© Easygel© test for fecal coliform bacteria
- Update information about the use of charcoal packet dye testing



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- As part of indicator testing stage, review any lab results for vector waste from the area if available
- Other indicators to consider adding or revising:
  - Caffeine
  - Move *E. coli* bacteria up to be a primary indicator (rather than alternative)
  - Combinations of: caffeine and fecal coliform bacteria, caffeine and cholesterol
  - Aquatic macroinvertebrates
  - Expand discussion of automated sampling to include new technology
  - Expand discussion of sediment trap sampling
  - Color test strips should be less prioritized as they are low resolution
  - For color determination, the depth of discharge, light source, and shading should be considered. Best to pull sample in glass container and evaluate in daylight.
  - Add natural gas and dead animals as an indicator for odorous discharges
  - Ammonium probe not useful
  - Visual indicators should be verified by other staff due to subjectivity
  - Surfactants pucks require special disposal
  - Need to know background levels when measuring:
    - Turbidity
    - Fluoride
    - Hardness
  - For metals measurement, include correction factors based on hardness.
  - Add test for total petroleum hydrocarbons.

## Source Tracing

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Source tracing methodologies with the highest usage count include CB or MH inspections, presence of flow, ditch inspections, business inspections, sample collection, reconnaissance by foot or vehicle and dye testing. Less commonly used are smoke testing, septic system inspections, optical brighteners, sand bagging, temperature monitoring, and thermography. In addition, the following comments stood out among the feedback on source tracing.

- For sand-bagging, add reminder to remove sand bags when finished.
- Expand dye testing description to include time to run test and neighborhood notification.
- Dye testing and smoke testing are labor-intensive both in preparation and execution and may require significant traffic control. Smoke testing requires significant pre-notifications in the target community.

- Create a sample questionnaire for homeowner/property owner interviews.
- Add infrared thermography as a source tracing option.

## **Manual organization and structure**

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- Incorporate updated permit language related to IDDE reporting and business inspections.
- Rank or prioritize activities/methodologies/indicators (and follow-up) based on level of investment and what is most effective to help resource-limited jurisdictions implement their programs.
- Create streamlined reference sheets or field guides/SOPs designed for field crews.
- Update equipment costs (Appendix A of Manual).
- Revise flow charts to provide more direct pathways to identifying discharge sources and criteria to know when it's appropriate to skip screening and/or indicator testing.
- Add discussion of allowable discharges to Manual
- Add an index to make the Manual easier to navigate
- Add more photos or visuals to the Manual

## **Data Collection and Management**

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Limited feedback was collected during the workshops and from the survey on how data are collected and managed. This information helps round out the picture of possible impediments to IDDE field data collection and also highlights the need for efficient ways to both collect and manage data.

The usage count of workshop participants was about even between collecting field data with paper forms versus digital media. This indicates that while paper note-taking is still used, using digital forms or devices to record field notes is also widely in use. For managing data, about twice as many participants indicated they use software such as CityWorks that is intended for multiple types of municipal data, compared to those who use databases dedicated to just IDDE work, such as MS Access or Excel.

Many participants said they take and store photographs and videos as part of their IDDE work, but most expressed dissatisfaction with how those files are managed. Some jurisdictions noted that photos and videos taken with a GPS-enabled device help alleviate some of the photo management, and others noted that good mapping software can help reduce the number of photos required for things like locating the illicit discharges.

The limited feedback obtained related to collecting and managing IDDE data support a review of these considerations in the 2013 IC-ID Manual. Specifically, the type and amount of data generated when using the various methodologies and indicator tests should be considered, and there may be opportunity to edit the information that would allow for easier data management.

## Training Locations

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Several locations for the upcoming trainings on the revised IC-ID Manual stood out with the most votes by workshop participants and survey respondents. However, the list of locations asked about was slightly different between the survey and the workshop. This was due to the project team's interest in getting feedback on a longer list of locations during the workshops than in the previously filled out survey.

The preferred locations were slightly different between the survey and workshops, which partly reflects the different mix of people who filled out the survey and who attended the workshops. Additionally, workshop participants were asked if each location was either preferred or possible to help further inform the project team which locations might draw the largest attendance.

The overall preferred training location results from both the workshops and survey are as follows:

- North Puget Sound: Mt. Vernon
- Central Puget Sound: Bellevue, Edmonds, Everett, Renton, and Seattle
- South Puget Sound: Puyallup and Tacoma
- West Puget Sound: Bremerton
- Non-Puget Sound: Vancouver

These location preferences will be considered during the planning of the training sessions. With just eight training sessions planned but 10 top preferred locations as noted above, the project team will use this feedback to schedule the trainings in locations that will draw the most participants. Other factors will also be considered, including cost to rent the space, parking availability, and feasibility of using public transportation to get to/from the trainings.

## References

King County and WSU, 2013, Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual. Prepared by King County, Washington Stormwater Center (WSC), and Herrera Environmental Consultants for Washington State Department of Ecology.

Center for Watershed Protection, 2014, Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments.

## Limitations

Work for this project was performed for King County (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

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## **APPENDIX A**

### **Workshop Materials**

- *Attendance Sheets*
- *Curriculum Slides*
- *Handouts*

## **APPENDIX B**

### **Survey Respondents**