

Attachment 2 Wastewater

1. Overview

1.1. Objective

The objective of this attachment is to set the minimum controls for planning and implementing flow isolation / flow management (FIFM) to ensure the safety of people exposed to the risk of engulfment by flow from wastewater assets.

1.2. Scope

This attachment applies to the following people who manage or work with wastewater assets where flow could engulf a person working in, on or near the asset:

- Person requesting FIFM.
- FIFM plan coordinator.
- Wastewater Networks Area Manager: the responsible manager for planned work.
- Wastewater System Operation Officer (SOO).
- Hydrometric Services Team Leader: the responsible manager for hydrographic work.
- Responsible person for FIFM: the person who will implement the FIFM schedule.
- Service provider who requires FIFM to work on the asset without being engulfed.

1.3. Summary

The person requesting FIFM must nominate a FIFM plan coordinator and submit a Request for FIFM to the relevant Manager or their nominated SOO, to initiate FIFM for planned work. This must be at least six weeks prior to the work.

The person requesting FIFM will also assume the roles of responsible manager for the FIFM and FIFM plan coordinator, for reactive work.

The responsible manager must decide if a FIFM plan is required by checking for special conditions or by doing a preliminary FIFM HIDRA to determine the risk of engulfment.

If a plan is required, the FIFM plan coordinator must not let FIFM be implemented until:

- they:
 - have allocated roles and responsibilities for the FIFM
 - have facilitated FIFM HIDRA
 - are satisfied that key participants have reviewed and acknowledge the HIDRA
 - have prepared a FIFM plan, including a trial FIFM schedule (if required)
- the responsible manager has approved the FIFM plan (with a trial if required)
- the responsible person for FIFM has accepted the FIFM plan.

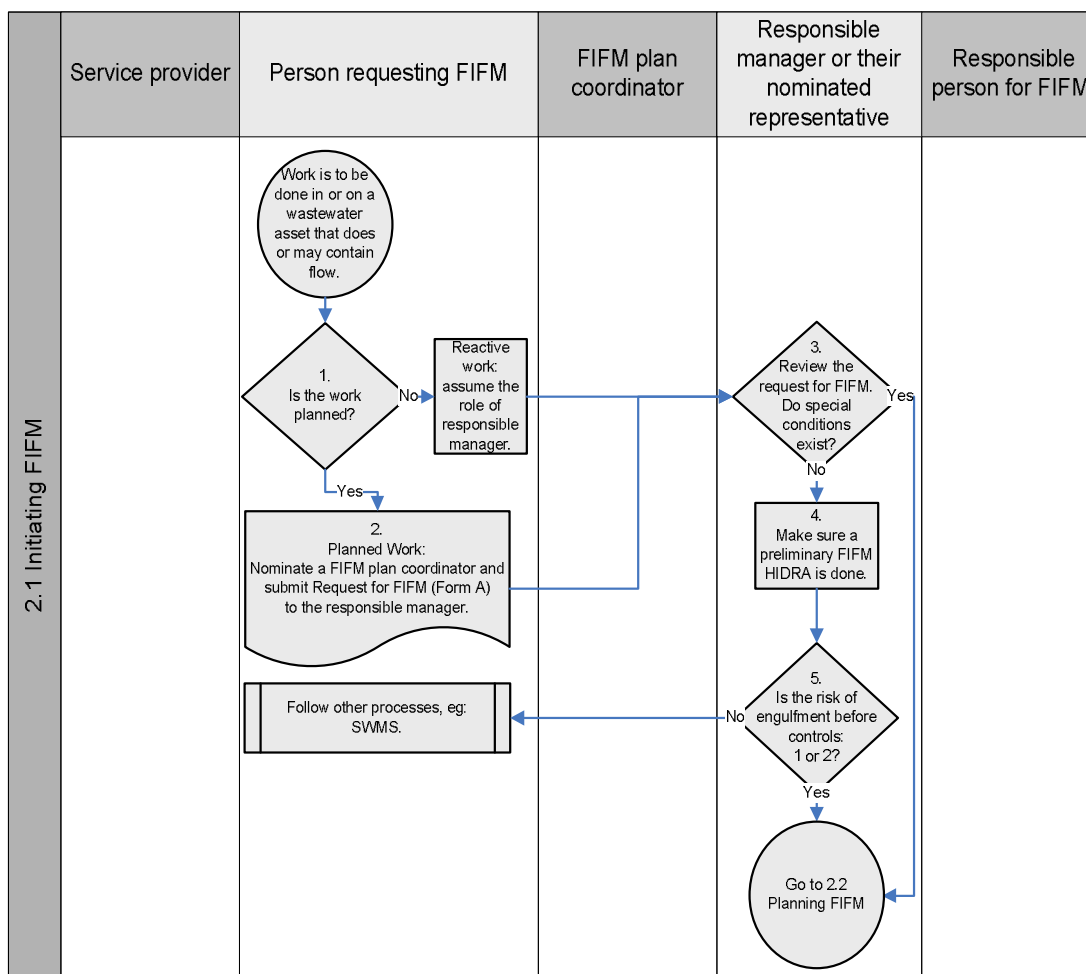
The FIFM plan coordinator must not let work commence on the asset until confirming that:

- people have accepted their responsibilities
- FIFM communication has been done
- the responsible person for FIFM has completed and proven the FIFM schedule
- controls are signed off, still applicable and that there are no new hazards.

The FIFM plan coordinator must not allow a responsible person for FIFM to recommission an asset until the service provider signs off that they have safely completed the work.

2. Procedure

2.1. Initiating FIFM



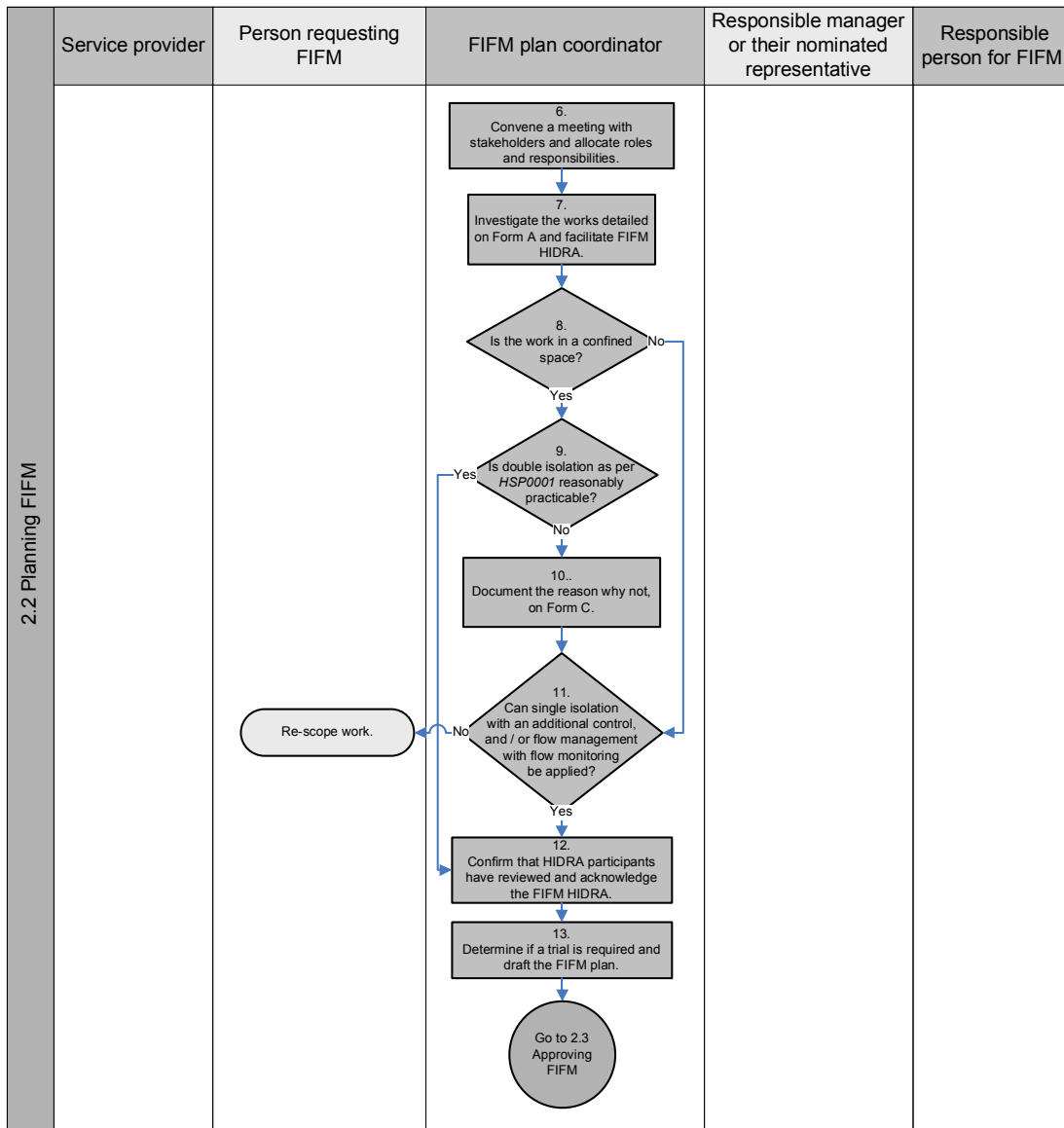
Box	Description	Who	Explanation	Forms
Work is to be done in or on a wastewater asset that does or may contain flow. Examples include: connecting, repairing or entering a pipe or wet well. This does not include opening a maintenance hole or hatch without entry.				
1	Is the work planned [or reactive]?	Person requesting FIFM.	Determine if the work is planned or reactive. If reactive, go to box 3. The person requesting FIFM will also assume the role of responsible manager. If planned, go to box 2. The relevant Wastewater Area Manager (or their nominated representative) will be the responsible manager.	Nil
2	Nominate a FIFM plan coordinator and submit Request for FIFM (Form A) to the responsible manager.	Person requesting FIFM.	a) Nominate a FIFM plan coordinator. b) Submit Form A to the relevant responsible manager (or their nominated representative) in Wastewater Networks. Form A must be submitted at least six weeks before the scheduled FIFM date. Make sure Form A includes all hazards that could cause a risk of engulfment due to uncontrolled sewage flow. The hazards identified will be used to determine the most appropriate FIFM.	A

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Box	Description	Who	Explanation	Forms
3	Review the request for FIFM. Do special conditions exist?	Responsible manager or their nominated representative	The responsible manager (or their nominated representative) reviews the Request for FIFM (Form A) and determines if any of the following special conditions exist: - significant safety risks, such as: - confined space entry with a risk of engulfment - work in a trench 1.5 m deep or more with a risk of engulfment - exposure to trade waste. - the removal of a section of pipework greater than 300 mm in diameter. - the removal of equipment, such as a: pump, macerator or valve greater than 300 mm in diameter. - removal of pressure or vacuum pipework of any diameter - potential to impact on customers, eg internal / external surcharge, odour, or flooding. - impacts on the environment eg external surcharge, odour, flooding - Impact on STS licence conditions. If any of these conditions exist, go to Section 2.2 Planning FIFM. If none exist, go to box 4.	
4	Make sure a preliminary FIFM HIDRA is done.	Responsible manager or their nominated representative	The purpose of the preliminary FIFM HIDRA is to determine if there is a risk of engulfment when there are none of the special conditions described in box 3.	
5	Is the risk of engulfment before controls ranked 1 or 2?	Responsible manager or their nominated representative	From the preliminary FIFM HIDRA in box 4, assess if the risk of engulfment before controls is ranked 1 or 2? If yes, go to Section 2.2 Planning FIFM. If not, follow other processes, such as: SWMS, SOP or similar. There is no requirement to follow this procedure.	

2.2. Planning FIFM

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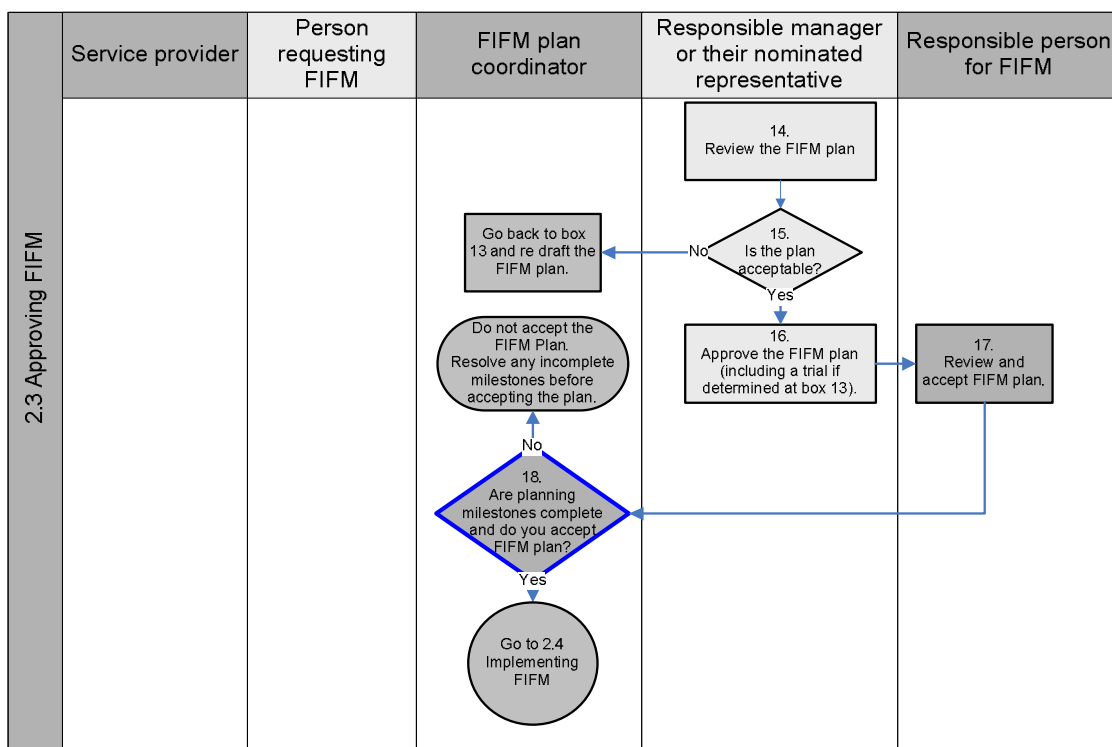
Box	Description	Who	Explanation	Forms
6	Convene a meeting with stakeholders and allocate roles and responsibilities.	FIFM plan coordinator	Convene a meeting to: - review the scope of work - review initial hazards and risks - identify potential: operational, environmental and customer impacts. Where relevant, information on the preliminary FIFM HIDRA and Form A should be considered. Allocate roles and responsibilities for the: - FIFM plan coordinator - responsible manager or their nominated representative - responsible person for FIFM - service provider. People nominated for these roles must accept their responsibilities by signing Form B.	B

Box	Description	Who	Explanation	Forms
7	Investigate the works detailed on Form A and facilitate the FIFM HIDRA (Form C).	FIFM plan coordinator . .	Consult the people nominated in box 6, and facilitate a FIFM HIDRA. The HIDRA must: - follow the instructions given in boxes, 8, 9, 10 and 11 below - consider all hazard(s) associated with the risk of engulfment as well as hazards and controls identified on Form A - include impacts on the environment, customer, community and business, where relevant - include a record of the FIFM HIDRA participants - refer to the emergency response, if the controls fail, eg evacuation procedure.	C
8	Is the work in a confined space?	FIFM plan coordinator . .	Does the FIFM HIDRA (Form C), show that the engulfment hazard is associated with work in a confined space, such as a pipe or well, as shown in example 1 of Appendix 1. If yes, go to box 9. If no, go to box 11.	C
9	Is double barrier isolation as described in <i>HSP0001 Confined Space Safety</i> reasonably practicable?	FIFM plan coordinator .	If the FIFM HIDRA (Form C) shows that the work is in a confined space, is it reasonably practicable to control the engulfment hazard with double barrier isolation as per <i>HSP0001 Confined Space Safety</i> , as shown in example 1 of Appendix 1. If yes, go to box 12. If no, go to box 10.	C
10	Document the reason why not, on Form C.	FIFM plan coordinator .	Document on Form C, the reason why double barrier isolation for confined space work is not reasonably practicable. Example 2 from Appendix 1 has examples of why it may not be reasonably practicable. Once this is done, go to box 11.	C
11	Can single isolation with an additional control, and / or flow management with flow monitoring be applied?	FIFM plan coordinator .	Assess if single isolation with an additional control and / or flow management with flow monitoring can be applied if double isolation is not reasonably practicable and the FIFM HIDRA (Form C) shows that the work is: - in a confined space with a risk of engulfment - not in a confined space but there is still a risk of engulfment. ☐ If yes, and for example, single isolation with an additional control can be applied: - at line 1 of Form C, specify what the single isolation will be, eg a closed valve, as shown in example 2 of Appendix 1 - at line 2 of Form C, specify what additional control will be used to ensure that the single isolation remains secure, by choosing from one of the options shown in example 2 of Appendix 1 - go to box 12. If no, hand back to the person requesting FIFM to re-scope the work.	C

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Box	Description	Who	Explanation	Forms
12	Confirm that HIDRA participants have reviewed and acknowledge the FIFM HIDRA.	FIFM plan coordinator	The FIFM plan coordinator signs off on Form K, line 4 when they are satisfied that all key HIDRA participants have reviewed and acknowledge the FIFM HIDRA (Form C).	K, line 4
13	Determine if a trial is required and draft the FIFM plan:	FIFM plan coordinator	The draft FIFM plan can now be developed. It may need to be re-developed later depending on the outcome of a trial FIFM. For planned work, the FIFM plan must be submitted to the relevant Wastewater Network Area Manager for review and approval at least 4 weeks prior to the scheduled FIFM date.	
	Determine if a trial FIFM and re-commissioning schedule is required.		A trial FIFM must be considered to prove the effectiveness of relevant controls in the FIFM plan. A trial should also be considered when there is significant uncertainty about the: safety, customer, environmental or political impacts that the FIFM may have, especially when system behavior can't be predicted. Experience shows that what has worked in the past, may not work on the day. A trial can be done separately or as the initial part of the FIFM plan implementation. If a trial FIFM is required, document the success factors for the trial on Form E, and circle Y (Yes) on Form K at line 7.	E
	Prepare communication for FIFM (if required).		A communication strategy should be considered depending on the risks and controls identified on Form C, for safety, environment, customer and business. Indicate on Form K (line 7) if a communication strategy is required, by circling Y or N.	D
	Prepare FIFM schedule.		It is mandatory that a FIFM schedule including a method of proving FIFM is prepared using Form H. Ensure this is signed on Form K, line 6, as prepared, before submitting for approval.	H K, line 6
	Prepare FIFM monitoring plan (if required).		If a FIFM monitoring plan is required, use Form I. If monitoring the operational status of a wet well is required, use Form G. Indicate on Form K (line 7) if either of these is required by circling Y or N.	I G K
	Prepare re-commissioning schedule.		It is mandatory that a re-commissioning schedule using Form J is completed.	J

2.3. Approving FIFM



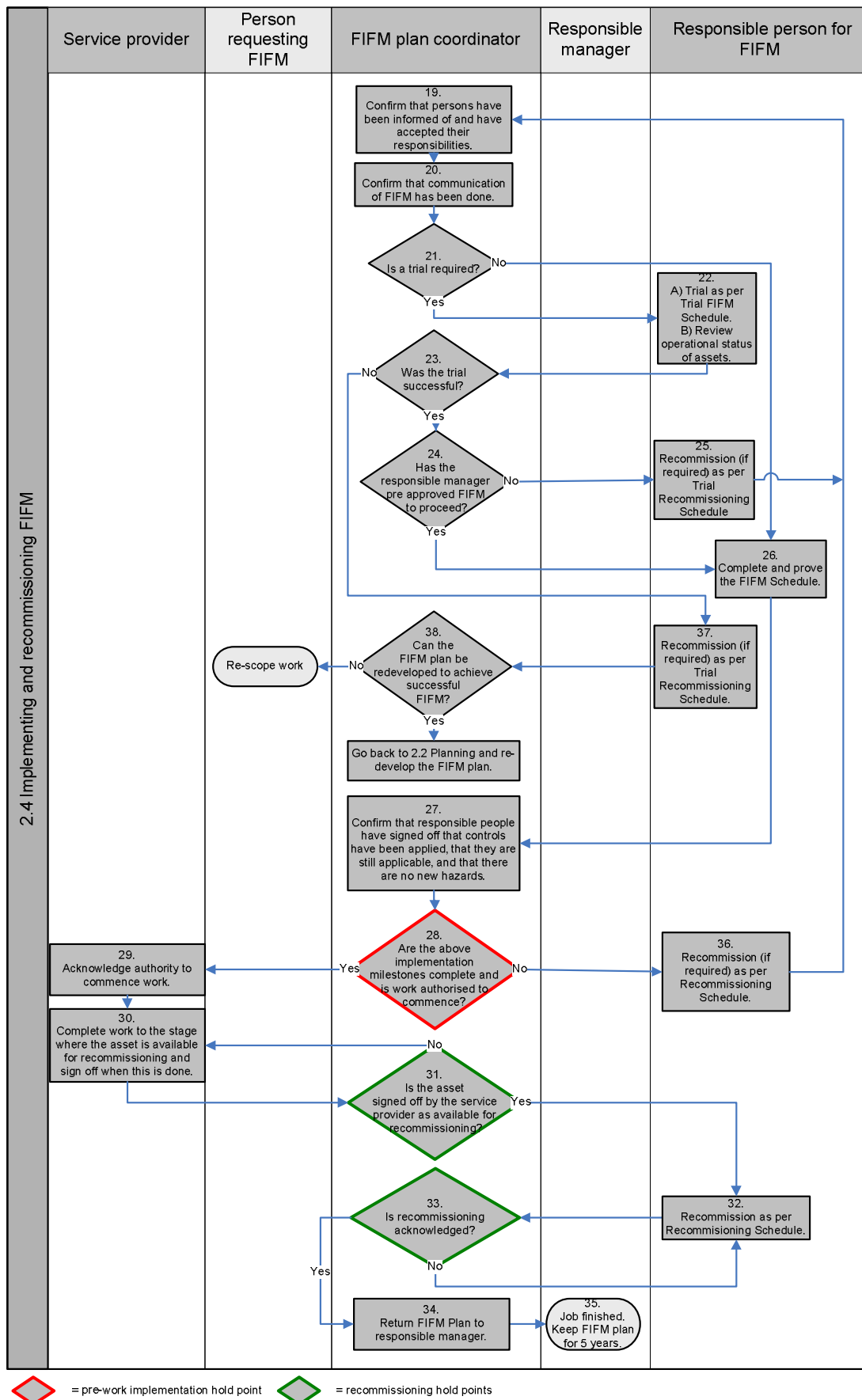
◆ = hold point

Box	Description	Who	Explanation	Forms
14	Review the FIFM plan.	Responsible manager or their nominated representative.	Review the plan including any requirements for a trial.	
15	Is the plan acceptable (including a trial if required at box 13)?	Responsible manager or their nominated representative.	If the plan is acceptable, go to box 16. If not, hand back to the FIFM plan coordinator to re draft the unacceptable parts of the plan.	
16	Approve FIFM plan.	Responsible manager or their nominated representative.	Approve Roles and Responsibilities (Form B) on Form K, line 2. Approve the FIFM HIDRA (Form C) on Form K, line 3. Approve the overall plan on Form K at line 7 as follows: Communication of FIFM (Form D). Trial FIFM and Recommissioning Schedule and checking the operational status of assets (Form E / F). If a trial is successful, can FIFM proceed to Form H without a trial recommissioning on Form E. FIFM Schedule, including method of proving successful FIFM (Form H). FIFM Monitoring Plan (Form I / G). Recommissioning Schedule (Form J).	K, line 2, line 3, line 7

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17	Review and accept the FIFM plan.	Responsible person for FIFM.	It is mandatory that a responsible person for FIFM from the area that will complete and prove the FIFM schedule on Form H, reviews and accepts the FIFM plan.	K, line 8
18	Are planning milestones complete and do you accept the FIFM plan?	FIFM plan coordinator.	This is a hold point. Confirm that milestones 2 – 8 on Form K have been completed. If a trial is required at milestone 7, confirm that this has been approved on Form E. If the planning milestones are complete, go to 2.4 Implementing FIFM. If any planning milestones are not complete, do not accept the plan. FIFM can't be implemented. Resolve any incomplete milestones before accepting the plan.	K line 9

2.4. Implementing and recommissioning FIFM



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Box	Description	Who	Explanation	Forms
19	Confirm that persons have been informed of and have accepted their responsibilities.	FIFM plan coordinator.	Confirm that Form B has been completed before signing Form K.	K, line10
20	Confirm that communication of FIFM has been done.	FIFM plan coordinator.	Confirm that Form D has been completed before signing Form K.	K, line11
21	Is a trial required?	FIFM plan coordinator.	Check Form K to see if the responsible manager has approved a trial FIFM. If a trial is required, go to box 22. If a trial is not required, go to box 26.	K, line 7
22	Trial as per Trial FIFM Schedule and review operational status of assets	Responsible person for FIFM.	Complete and prove the trial according to the sequence on Form E. Service providers are not permitted to do the work that requires FIFM, during trials. If the trial is not successful, record the reason why and any actions required, on Form E. Check the operational status of assets after the trial using Form F. Notify the FIFM coordinator when finished or if additional activities to complete the trial are required.	E F
23	Was the trial succesful?	FIFM plan coordinator.	Assess the trial against the pre-determined success factors on Form E. If the trial was successful, go to box 24. If the trial is not successful, go to box 38 (via box 37 if the asset needs to be recommissioned in the meantime).	E
24	Has the responsible manager pre approved the FIFM to proceed.	FIFM plan coordinator	If the trial FIFM is successful and the work is able to commence, there may not be a need to do a trial recommissioning. The actual FIFM schedule can proceed if the responsible manager has given pre approval on Form K, line 7. If so, go to box 26. If the trial was successful but the responsible manager has not approved FIFM to proceed, for instance, the work can't be completed within a certain time period, go to box 25.	K, line 7
25	Recommision (if required) as per Trial Recommissioning Schedule.	Responsible person for FIFM.	Recommission as per the sequence on Form E, and inform the FIFM plan coordinator when this is done.	E

Box	Description	Who	Explanation	Forms
26	Complete and prove the FIFM schedule.	Responsible person for FIFM.	Complete and prove the actual FIFM schedule according to the sequence on Form H, and sign off on Form K when this is done. Identify any risks associated with operational assets, such as: pipes, valves or pumps, and confirm their operational status. If any of the activities are unable to be completed, consult the responsible manager to identify additional FIFM activities to enable FIFM. If they still can't be completed, notify the FIFM plan coordinator to cancel work.	H and K, line 12
27	Confirm that responsible people have signed off that controls have been applied, that they are still applicable, and that there are no new hazards.	FIFM plan coordinator	Confirm that Form C has been completed and signed off before signing Form K. Also, check that these controls are still relevant to when the FIFM HIDRA was done and that no new hazards are present.	K, line 12
28	Are the above implementation milestones complete and is work authorised to commence?	FIFM plan coordinator	This is a hold point. If it is confirmed that forms B,C and D have been signed off, and that the FIFM plan schedule (Form H) has been completed and proven, go to box 29. If any these forms are not signed off and / or Form H has not been completed and proven, work is not authorised to commence. In this case, go back to box 19 (via box 36 if the asset needs to be recommissioned in the meantime) and reconfirm any of the forms B, C, D and H as necessary.	K, line 14
29	Acknowledge authority to commence work.	Service provider.	The service provider signs off Form K line 15, only after the FIFM plan coordinator signs off Form K, line 14. The service provider must not commence work until these are signed.	K, line 15
30	Complete work to the stage where the asset is available for recommissioning.	Service provider.	The service provider completes the work up to the re-commissioning stage and signs off on Form K, line 17 when this is done.	K, line 17
31	Is the asset signed off by the service provider as available for recommissioning?	FIFM plan coordinator.	This is a hold point. If work is signed off as completed, go to box 32. If work is not signed off as completed, go back to box 30.	K, line 18
32	Recommission as per the Recommissioning Schedule.	Responsible person for FIFM.	Recommission the assets as per the sequence on Form J, and sign off on Form K when this is done. If recommissioning is not successful, give the reason why on Form J.	J and K, line 20

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Box	Description	Who	Explanation	Forms
33	Is recommissioning acknowledged?	FIFM plan coordinator.	This is a hold point. If recommissioning is acknowledged, go to box 34. If recommissioning is not acknowledged, go back to box 32.	K, line 21
34	Return the FIFM plan to the relevant responsible manager.	FIFM plan coordinator.	This includes details of the work performed as well as the completed forms in the FIFM plan. Document any isolation or recommissioning issues for future reference.	K, line 21
35	Job finished. Keep FIFM plan for 5 years.	Responsible manager.	Records must be available for auditing purposes.	
36	Recommison (if required) as per recommisioning schedule.	Responsible person for FIFM.	Recommission the assets as per the sequence on Form J.	J
37	Recommison (if required) as per trial recommissioning schedule.	Responsible person for FIFM.	Recommission the asset as per the sequence on Form E.	E
38	Can the FIFM plan be re-developed to achieve successful FIFM?	FIFM plan coordinator.	Review the FIFM plan to see if it can be re-developed. Amend the plan as necessary and re-trial until the trial is successful. Modify any forms as required and resubmit for approval. If the plan can be re-developed, go back to 2.2 Planning and re-develop the FIFM plan. If the plan can't be re-developed, the work can't meet the requirements of this procedure and needs to be re-scoped.	

Appendix 1: Examples of FIFM HIDRA for Wastewater

Example 1: Double barrier isolation

HIDRA FOR FLOW ISOLATION / FLOW MANAGEMENT

FORM C

PROJECT TITLE / NAME	Context Of Assessment	Person(s) Conducting Assessment
Dig and repair of sewer rising main.	Risk of uncontrolled sewage flow filling the work area (2 m deep narrow trench) and a single valve not being effective in isolating the flow.	Sue Erfix and Rhys Ingmain
		<i>Date Of Assessment</i>

CAT.
SEVERE
MODERATE
MINOR
INSIGNIF.

Very Likely	Likely	Unlikely	Very Unlikely
1	1	2	3
1	2	3	4
2	3	4	5
3	4	5	6
4	5	6	6

Hazard	Impact		Risk Before Controls			CONTROLS (List all controls – current and required – intended to support the development of safe systems of work)	Risk After Controls			Group responsible to implement control	Sign off – controls applied	
<i>What can harm you?</i>	<i>What can happen?</i>	<i>How it can happen?</i>	Consequence	Likelihood	Risk Rating	Note: this example would comply with HSP0001 Confined Space Safety.	Consequence	Likelihood	Risk Rating		<i>Print Name</i>	<i>Signature</i>
Engulfment by sewage.	Drowning.	Uncontrolled flow fills confined space trench with sewage while working in it.	Catastrophic	Very Likely	1	Double barrier isolation: The nearest valve on the hydraulic source to the work site (i.e.: at SPS 1) will be isolated as per <i>HSP0049 Lock Out / Tag Out</i> . The nearest pump on the hydraulic source to the work site (i.e.: at SPS 1) will be isolated as per <i>HSP0049 Lock Out / Tag Out</i> . Proving isolation, dewatering and monitoring for leakage will be done by: - Loosening the flange in-between the pump and the valve, or - Opening a drain valve downstream of the SPS, These will be isolated as per <i>HSP0049 Lock Out / Tag Out</i> .	Catastrophic	Unlikely	2			

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Example 2: Single barrier isolation with an additional control and flow management with flow monitoring? (i.e.: double barrier isolation is not reasonably practicable)

HIDRA FOR FLOW ISOLATION / FLOW MANAGEMENT

FORM C

PROJECT TITLE / NAME	Context Of Assessment	Person(s) Conducting Assessment
Replace pump at SPS 2.	Risk of uncontrolled sewage flow filling the work area and a single valve not being effective in isolating the flow.	Sue Erchoke and Con Finedspace
		<i>Date Of Assessment</i>

CAT.
SEVERE
MODERATE
MINOR
INSIGNIF.

Very Likely	Likely	Unlikely	Very Unlikely
1	1	2	3
1	2	3	4
2	3	4	5
3	4	5	6
4	5	6	6

Hazard	Impact	Risk Before Controls	CONTROLS (List all controls – current and required – intended to support the development of safe systems of work)	Risk After Controls	Group responsible to implement control	Sign off – controls applied
<i>What can harm you?</i>	<i>What can happen?</i>	<i>How it can happen?</i>	Consequence Likelihood Risk Rating	Note: This example would comply with section 2.2.2 of HSP0070 FIFM.	Consequence Likelihood Risk Rating	Initials Signature
Engulfment by sewage in confined space.	Drowning	Uncontrolled flow fills dry well with sewage while working in it.	Catastrophic Very Likely 1	Single Isolation: The nearest valve both upstream and downstream of the pump replacement will be isolated as per HSP0049 Lock Out / Tag Out.	Catastrophic Unlikely 2	
		A single valve isolating the asset is operated while workers are in dry well.	Catastrophic Unlikely 2	Choose from one of the following additional controls: Lock out: The closed valves will be isolated as per HSP0049 Lock Out / Tag Out. Or Prevent access: Access to the valves will be barricaded and signposted to prevent them from being inadvertently opened. Or Monitor for leakage: The valves are likely to be lockable / guardable and monitoring for leakage is not an option in this instance. As an extra precaution, flow management / monitoring as described below, will be done. Or Guard the isolation: The valves will be guarded to prevent them from being opened.	Catastrophic Very Unlikely 3	

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						And: Flow Management: The adjacent wet well will be pumped down before the valves are closed and work commences on the pump. Work will then only be done under low flow conditions, i.e.: outside of peak system demand times and when there is no rainfall in the associated stormwater catchment over the previous 48 hours. Flow monitoring: The level in the adjacent wet well will be monitored and the pump replacement crew alerted for evacuation should levels increase above the suction intake.							
Comments: It is not reasonably practicable to implement double isolation as described in <i>HSP0001 Confined Space Safety</i> because the time, cost and risk to safety and public health of isolating the gravitational inflows upstream of the SPS, outweighs the risk to safety of doing the pump replacement.													

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Example 3: Flow management with flow monitoring (i.e.: double barrier isolation is not reasonably practicable)

HIDRA FOR FLOW ISOLATION / FLOW MANAGEMENT

FORM C

PROJECT TITLE / NAME	Context Of Assessment	Person(s) Conducting Assessment
Inspection of Boggo Rd sewer main.	Traversing the sewer main.	Travis Sewermain
		<i>Date Of Assessment</i>

CAT.
SEVERE
MODERATE
MINOR
INSIGNIF.

Very Likely	Likely	Unlikely	Very Unlikely
1	1	2	3
1	2	3	4
2	3	4	5
3	4	5	6
4	5	6	6

Hazard	Impact		Risk Before Controls			CONTROLS (List all controls – current and required – intended to support the development of safe systems of work)	Risk After Controls			Group responsible to implement control	Sign off – controls applied	
<i>What can harm you?</i>	<i>What can happen?</i>	<i>How it can happen?</i>	Consequence	Likelihood	Risk Rating	Note: This example would comply with section 2.2.2 of HSP0070 FIFM.	Consequence	Likelihood	Risk Rating		Print Name	Signature
1. Engulfment by sewage in confined space.	Drowning	Uncontrolled sewer flow fills pipe while doing traverse.	Catastrophic	Very Likely	1	Flow management: Work will only be done under low flow conditions, i.e.: outside of peak system demand times and when there is no rainfall in the associated stormwater catchment over the previous 48 hours.	Catastrophic	Unlikely	2			
2. Engulfment by sewage in confined space.	Drowning	Flow management fails while doing the traverse.	Catastrophic	Unlikely	2	Flow monitoring: Sewer flow upstream of the traverse will be monitored for increases in flow as will BOM rainfall forecasts for the associated stormwater catchment, and the inspection crew alerted for evacuation should flow increase or rainfall / flash flooding occur.	Catastrophic	Very Unlikely	3			
Comments: It is not reasonably practicable to use double barrier isolation on every source of flow to the work area because the time, cost and risk to safety and the environment of isolating all of the gravitational inflows along the path of the traverse, outweighs the risk to safety of doing the traverse.												

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Guidelines to assist in doing FIFM HIDRA for wastewater assets

HIDRA must be done according to HSP0014 HIDRA.

Note 1: This is not a HIDRA for the overall project. This HIDRA applies to the work / activity, which is part of the overall project, but where FIFM is required to complete work without being engulfed.

Note 2: Wastewater assets can be under either gravity or pressure.

The following table gives examples of hazards and potential risks that may result in a risk rating of 1 or 2 before controls.

This is a guide only and only applies to the FIFM activity. It is not a definitive list.

Hazard (What can harm you)	Impact / Risk (Examples of how it can happen)
Engulfment of work site / area (sudden increase in water level).	• Failure of valve / gate / penstock utilised to isolate the work site / area. • Valve / gate / penstock utilised to isolate work site / area is opened by a third party. • Upstream pumping station operates. • Third party work upstream resulting in release of water eg jetter operation.
Sucked / pushed into downstream pipe (after sudden increase in water level).	• Downstream pipe diameter is ≥ 500 mm.
Engulfment of work site / area (slower increase in water level).	• Variation of gravity flows across the day. • Rain in the upstream catchment.
Discharge of sewage to the environment (waters).	• Bypass / diversion has insufficient capacity. • Variation of gravity flows across the day. • Failure of valve / gate / penstock utilised to isolate the work site / area. • Valve / gate / penstock utilised to isolate work site / area is opened by third party. • Upstream pumping station operates.
Discharge of sewage affecting customer.	• Bypass / diversion has insufficient capacity. • Variation of gravity flows across the day. • Failure of valve / gate / penstock utilised to isolate the work site / area. • Valve / gate / penstock utilised to isolate work site / area is opened by a third party. • Upstream pumping station operates.
Entry into sewer / SPS wet well.	• Toxic gas. • Illegal dump of chemicals. • Trade waste affected sewage.

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Appendix 2: No of turns of valve spindle for gate valves with a pressure rating between 122 – 160 m

* indicates approximate number of turns

MS = metal seated gate valve

RS = resilient seated gate valve

N/A = NOT AVAILABLE

Valve size DN	Gordon Marr before 1977 MS (note 1)	Gordon Marr since 1977 MS (note 2)	Tyco before 1992 MS (note 3)	Tyco since 1992 MS & RS (note 4)	John Valves MS (note 5)	John Valves RS (note 5)	AVK RS (note 6)
100	17*	9*	9	23	18	17	9
150	26*	14*	14	26	13	25	14
200	34*	18*	18	34	17	32	18
225	39*	20*	20	38	19	32	19
250	43*	23*	22	42	22	51	22
300	52*	27*	26	50	26	62	26
375	64*	34*	32	62	24	N/A	32
450	77*	41*	38	76	30	N/A	40
500	43	43	42	82	33	N/A	44
600	51	51	51	98	38	N/A	53

Notes:

1. Approximate number of turns for DN 100 – DN 450 based on Water Board Standard drawing WBS 1005 for spindles, i.e. 6.35 mm lead for DN 80 – DN 450 and 12.7 mm lead for DN 500 and DN 600. Number of turns for DN 500 and DN 600 based on WBS 1037, 1038, 1039 and 1040.
2. Approximate number of turns for DN 100 – DN 450 based on Water Board Standard drawing WBS 1609 for spindles, i.e. 12.0 mm lead for DN 80 – DN 450. Number of turns for DN 500 and DN 600 based on WBS 1037, 1038, 1039 and 1040.
3. Tyco's email dated 23 Nov 2006.
4. Tyco's product catalogue.
5. John Valves' email dated 19 and 20 Feb 2007. NB: John Valves do not manufacture RS valves in sizes larger than DN 300.
6. AVK's email dated 6 Dec 2006.

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