A Decision Support System for Drinking Water Production Integrating Health Risks Assessment

Table S1. Anthropized catchment Risk Assessment.

Item	Factor	Choice	Risk Score
		Absence	0
	Cattle/calves livestock unit per ha of forage area (LDI *)	≤1	1
		>1	3
		Absence	0
	Sheep/lambs livestock unit per ha of forage area (LDI *)	≤1	1
		>1	3
		Absence	0
	Pig livestock unit per ha of forage area (LDI *)	≤1	1
		>1	3
Animals	Poultry livestock unit per ha of forage area (LDI *)	Absence	0
		≤1	1
		>1	3
	Any other farmed animals or birds	Absence	0
		Presence	1
	Evidence of wildlife around the catchment	Absence	0
		Presence	2
	Animals access to water sources including feeder streams	No access (natural or artificial barrier)	0
		Access possible at a distance > 200 m from the catchment	1
		Access possible at a distance < 200 m from the catchment	3
	Farm waste (Slurry/Dung) or sewage sludge spreading within the	Absence	0
	catchment	Presence	3
Agricultural	Slurry/dung open stores	Absence	0
practices within		Presence	3
the catchment	Cultivated lands with crops	Absence	0
The cutchinicit		<20%	1
		20%–50%	2
		>50%	3

Table S1. Cont.

Item	Factor	Choice	Risk Score
		Absence	0
	Cultivated lands with such and a/vin sucuda	<10%	1
Agricultural	Cultivated lands with orchards/vineyards	10%-30%	2
practices		>30%	3
within the	Awareness of the presence of drinking water supply/sources	Good awareness	0
catchment	by agricultural workers	No Awareness	2
	Full compliance with Good Agricultural Practice Regulations	Yes	0
	verified by catchment inspection	No	3
	Conditional and a second of the	Absence	0
	Septic tanks serving population	Presence	2
		Yes	2
	Flooding of septic tanks on flood plains	No	0
		Absence	0
	D 11 11 11 11 11 11 11 11 11 11 11 11 11	< 5000	1
	Pop equivalent served by all wastewater Works	5000-50,000	2
		>50,000	3
	Presence of tourism infrastructures served by private	Yes	2
Urban &	on-site wastewater treatment systems	No	0
Industrial	Presence of hospital	Yes	3
Discharge		No	0
	Presence of industries	Yes	3
		No	0
	Evidence of malfunction on one or more on-site wastewater	Yes	3
	treatment systems	No	0
	Presence of landfill sites in the catchment	Yes	3
		No	0
		Absence	0
	Wastewater works discharge distance from catchment point	>10 km	1
		≤10 km	2

Table S1. Cont.

Item	Factor	Choice	Risk Score
	Storm water overflows	Absence	0
		Presence	3
IIh.o P.	Integrated Pollution management plan discharge from	Yes	-1
Urban & Industrial	intensive agricultural activity or agricultural related discharge	No	2
Discharge	All wastewater treatment plants complying with the Urban	Yes	0
Discharge	WasteWater Treatment Directive quality standards	No	2
	IIV inactivation at outlet of westewater treatment plants	Yes	-1
	UV inactivation at outlet of wastewater treatment plants	No	1
		Upland reservoir/lake	1
	Water source type	Lowland long term storage reservoir/lake	2
		Upland river or stream—bank side storage	2
		Upland river or stream—direct abstraction	3
Catchment		Lowland river or stream—direct abstraction or bank side storage	3
characteristics	Clamas	>10% near the catchment	2
	Slopes	≤10% near the catchment	0
	DOC Trends	Decreasing	-2
		Stable	0
		Increasing	2
	Catchment inspections frequency	1 per month or more	-1
		Between monthly and annually	0
		1 per year or less	1
Catchment	Procedures in place to deal with irregularities on the	In place	-1
management _	catchment	No procedure	1
		In place	-1
	Catchment protection areas implementation	Procedure started	0
		Procedure not started	1

Note: * LDI: Livestock Density Index

Table S2. Natural catchment Risk Assessment.

Item	Factor	Choice	Risk Score
		Absence	0
	Cattle/calves livestock unit per ha of forage area (LDI *)	≤1	1
		>1	3
		Absence	0
	Sheep/lambs livestock unit per ha of forage area (LDI *)	≤1	1
		>1	3
		Absence	0
	Pig livestock unit per ha of forage area (LDI *)	≤1	1
		>1	3
Animals		Absence	0
	Poultry livestock unit per ha of forage area (LDI *)	≤1	1
		>1	3
	Any other farmed animals or birds	Absence	0
		Presence	1
	Evidence of wildlife around the catchment	Absence	0
		Presence	2
	Animals access to water sources including feeder streams	No access (natural or artificial barrier)	0
		Access possible at a distance > 200 m from the catchment	1
		Access possible at a distance < 200 m from the catchment	3
	Farm waste (Slurry/Dung) or sewage sludge spreading	Absence	0
	within the catchment	Presence	3
Agricultural	Slurry/dung open stores	Absence	0
practices within the catchment		Presence	3
	Awareness of the presence of drinking water	Good awareness	0
in cutchinent	supply/sources by agricultural workers	No Awareness	2
	Full compliance with Good Agricultural Practice	Yes	0
	Regulations verified by catchment inspection	No	3

Table S2. Cont.

Item	Factor	Choice	Risk Score
	Septic tanks serving population	Absence	0
		Presence	2
	Flooding of centic tenks on flood plains	Yes	2
	Flooding of septic tanks on flood plains	No	0
	Presence of Wastewater Works	Yes	1
	Trescrice of Wasiewater Works	No	0
	Presence of tourism infrastructures served by private	Yes	2
	on-site wastewater treatment systems	No	0
	Presence of hospital	Yes	3
	Tresence of nospital	No	0
	Presence of industries	Yes	3
	Presence of industries	No	0
	Evidence of malfunction on one or more on-site	Yes	3
Urban &	wastewater treatment systems	No	0
Industrial	Presence of landfill sites in the catchment	Yes	3
Discharge	Trescrice of fandrin sites in the eatenment	No	0
Discharge	Wastewater works discharge distance from catchment point (how much PE?)	Absence	0
		>10 km	1
		≤10 km	2
	Storm water overflows	Absence	0
		Presence	3
	Integrated Pollution management plan discharge from intensive agricultural activity or agricultural related discharge	Non applicable	0
		Yes	-1
		No	2
	All wastewater treatment plants complying with the Urban	Non applicable	0
	WasteWater Treatment Directive quality standards	Yes	0
		No	2
		Non applicable	0
	UV inactivation at outlet of wastewater treatment plants	Yes	-1
		No	1

 Table S2. Cont.

Item	Factor	Choice	Risk Score
		Upland reservoir/lake	1
		Lowland long term storage reservoir/lake	2
	Water source type	Upland river or stream—bank side storage	2
		Upland river or stream—direct abstraction	3
Catchment		Lowland river or stream—direct abstraction or bank side storage	3
characteristics	Slopes	>10% near the catchment	2
	Siopes	≤10% near the catchment	0
		Decreasing	-2
	DOC Trends	Stable	0
		Increasing	2
		1 per month or more	-1
	Catchment inspections frequency	Between monthly and annually	0
		1 per year or less	1
Catchment	Procedures in place to deal with irregularities on the	In place	-1
management	catchment	No procedure	1
		In place	-1
	Catchment protection areas implementation	Procedure started	0
		Procedure not started	1

Note: * LDI: Livestock Density Index

 Table S3. Treatment Risk Assessment.

Item	Factor	Choice	Risk Score
		Buffer tank	-1
		Simple sand filtration (not slow sand filtration)	-1
		Coagulation with aluminium	-2
		Coagulation with ferric chloride	-2
		DAF/sedimentation and filtration	-1
		Rapid gravity or pressure filtration	-2
Water		Slow sand filtration	-2
treatment	Water treatment processes	Granular activated carbon	-2
processes		Powder activated carbon	-2
		Membrane filtration (approved)	-3
		Membrane filtration (not approved)	-2
		Chlorination (HClO, ClO2, Cl2 gazeous)	-2
		UV disinfection	-2
		Nanofiltration	-2
		Ozonation	-2
	Water quality monitor	Not appropriate	1
Raw water	water quanty monitor	Appropriate alarmed and connected to telemetry	-1
intake		No	1
management	Intake shut down when poor water quality	Manual	-1
		Automatic	-2
	Coagulation: coagulant dose (and or pH) control	Absence	2
Treatment works monitoring		Manual control (not flow proportional)	0
		Monitored and alarmed	-1
	After clarification/Filtration—water turbidity meter/	No turbidity meter or particle count	1
	particle counter	turbidity meter/particle count but no alarm on telemetry	0
	particle counter	turbidity meter/particle count with alarm on telemetry	-1

 Table S3. Cont.

Item	Factor	Choice	Risk Score
	After clarification/Filtration—monitoring for	Not monitored	0
		Routine discrete monitoring for residual coagulant	-1
	residual coagulant	Continuous monitoring for residual	-2
		Non applicable	0
	Membrane filtration—Plant monitored for integrity	Not monitored	1
Treatment	Memorane miration—Frant monitored for integrity	Plant monitored for integrity but not alarmed	0
works		Plant monitored and alarmed for integrity	-1
monitoring	Membrane filtration—Particle counter used continuously to	Non applicable	0
	monitor filter performance	Yes	-1
	monitor fitter performance	No	1
	Disinfection—Plant monitored for integrity and correct dosage	Not monitored	1
		Plant monitored for integrity and correct dosage but no alarm	0
		Plant monitored and alarmed for integrity and correct dosage	-1
Filter	Treated water turbidity increases range, excluding normal	Less than 50%	0
performance	backwash period or turbidity in the final water >1.0 NTU	More than 50%	1
	UV inactivation—Influent turbidity consistently	<0.2 NTU	-2
		0.2–1.0 NTU	-2
Disinfection		>1.0 NTU	-1
performance	Free chlorine residual consistently	Not monitored or <0.1 mg/L	2
		0.1–0.3 mg/L	-2
		>0.3 mg/L	1
	Plant with documented management systems that includes procedures and process maintenance/control manuals	Yes—complete	-1
Treatment works operation		Yes but incomplete	0
		No	1
	Process control manuals specific to works available	Yes—complete	-1
		Yes but incomplete	0
		No	1

Table S3. Cont.

Item	Factor	Choice	Risk Score
	Auditable action along available for dealing with devictions	Available—complete	-1
	Auditable action plans available for dealing with deviations in quality and evidence of implementation of the plan	Available but incomplete	0
	in quanty and evidence of implementation of the plan	Not available	1
		>1 per month or more	-1
	WTP inspections carried out	Between monthly and annually	0
T		1 per year or less	1
Treatment	Water flow through works when operating has increased by	Yes	1
works		No	0
operation	Flow through works above design flow for >10% of time in	Yes	2
	last 12 months	No	0
	Flow through works >130% above design flow for >50%	Yes	2
	of time in last 12 months	No	0
	Filters humaned during the coop	Yes	1
	Filters bypassed during the year	No	0

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