CLAIMS

1. **A remote sensing device** for monitoring a condition within a water infrastructure network comprising:

an antenna unit configured to be located at or towards a top surface of a water infrastructure component in the water infrastructure network, the antenna unit comprises a flat base for engaging with the top surface of the water infrastructure component, the antenna unit having an elongate connection shaft comprising a hollow depending therefrom, the elongate connection shaft providing a mounting structure on the underside of the water infrastructure component for receiving and supporting a structure;

a monitoring unit for housing electrical components including a sensor for detecting a parameter, the monitoring unit removably mounted to the antenna

wherein the monitoring unit comprises a hub for mounting the monitoring unit to the elongate connection shaft, the hub being a region of the monitoring unit surrounding an opening of the monitoring unit, the opening configured such that the elongate connection shaft passes completely through the housing of the monitoring unit;

wherein the electrical components are located in a cavity of the monitoring unit, arranged to be spaced radially around the hub and the monitoring unit is located in a region between the top and bottom ends of the elongate connection shaft; and

wherein the antenna unit and monitoring unit are separate and individually water-tight structures.

2. The remote sensing device as claimed in ~~the previous~~ claim 1 wherein the elongate connection shaft comprises an external thread for making the essentially rigid connection~~.~~.

~~3.~~ ~~The remote sensing device as claimed in the previous claim~~ further comprising a nut associated with the threaded elongate connection shaft, the nut having a large engaging surface for engaging against the component of infrastructure to form the essentially rigid connection.

~~4. The remote sensing device as claimed in the previous claim wherein the nut indirectly engages the component and the device includes one or more washers or gaskets.~~

~~5.~~3. The remote sensing device as claimed in ~~any one of~~ claim~~s~~ 1 ~~and~~ or claim 2 wherein the elongate connection shaft is connected directly to the component of infrastructure to form the essentially rigid connection~~.~~, and

~~6. The remote sensing device as claimed in the previous claim~~ wherein an external thread of the elongate connection shaft engages directly with the component of infrastructure.

~~7. The remote sensing device as claimed in claim 5 wherein the elongate connection shaft is welded to the component of infrastructure.~~

~~8. The remote sensing device as claimed in any one of the previous claims wherein the elongate connection shaft receives a cable connection.~~

~~9.~~4. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 3 wherein an electrical connection is formed between the antenna unit and monitoring unit at the same time as a mechanical connection between the units is established with one motion~~.~~, and

~~10. The remote sensing device as claimed in the previous claim~~ wherein the electrical connection is a push type electrical connector incorporated with the elongate connection shaft.

~~11. The remote sensing device as claimed in anyone of the previous claims wherein the antenna unit and monitoring unit are rotatable to their operating position before securing the units in position.~~

~~12.~~5. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 4 wherein the monitoring unit comprises one or more drain ports located on the hub for water to pass through the monitoring unit, without entering the cavity housing the electrical components.

~~13.~~6. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 5 wherein in plan view, the monitoring unit comprises one of the following general housing profiles:

a) donut,
b) ring,
c) partial-ring,
d) horseshoe.

~~14.~~7. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 6 wherein the sensor is one of the following:

a) water level sensor,
b) non-contact flow sensor,
c) gas sensor,
d) temperature sensor,
e) moisture sensor,
f) tamper sensor,
g) vibration sensor, or
h) light sensor.

~~15.~~8. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 7 wherein the sensor is a radar sensor comprising a lens~~.~~, and

~~16. The remote sensing device as claimed in the previous claim~~ wherein the lens is integrated with a housing of the monitoring unit.

~~17.~~9. The remote sensing device as claimed ~~in any one of claims 15 to 16~~claim 8 wherein the monitoring unit comprises a water rejecting region in a focal area of the lens~~.~~, and

~~18. The remote sensing device as claimed in the previous claim~~ wherein the water rejecting region is a ramp on a housing surface of the monitoring unit for draining water downwards away from the focal area.

~~19.~~10. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 9 wherein ~~the~~ electrical components housed in the monitoring unit comprises one or a combination of:

a) a controller,
b) a wireless communication module,
c) a power supply~~.~~, and

~~20. The remote sensing device as claimed in any one of the previous claims~~ wherein all the electrical components are housed within one monitoring unit.

~~21. The remote sensing device as claimed in any one of the previous claims wherein the cable connection is protected by a hollow connection shaft sleeve.~~

~~22. The remote sensing device as claimed in any one of the previous claims wherein the antenna unit has a trafficable shape such as a dome shape.~~

~~23.~~11. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 10 wherein the monitoring unit comprises an upper housing portion and a lower housing portion, the upper housing portion comprises downwards facing shell profile and the lower housing portion comprises a substantially flat lid profile~~.~~, and

~~24. The remote sensing device as claimed in the previous claim~~ wherein a single gasket is provided between the upper housing portion and the lower housing portion to seal a mating surface between the housing portions.

~~25.~~12. The remote sensing device as claimed in ~~the previous~~ claim 11, wherein the component of infrastructure is a:

a) manhole cover
b) grate
c) cap
d) lid.

~~26. The remote sensing device as claimed in any one of the previous claims wherein the monitoring unit is configured to be located on an underside of the water infrastructure component unit via the elongate connection shaft.~~

~~27.~~13. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 12 further comprising a connection assembly to secure the device to the water infrastructure component, the connection assembly comprises:

a primary antenna fastener to secure the antenna unit to the water infrastructure component via the elongate connection shaft to make an essentially rigid connection; and

a primary unit fastener to secure the monitoring unit to an underside of the component.

~~28. The remote sensing device as claimed in any one of the previous claims wherein wherein the monitoring unit is spaced from the bottom surface of the component by a washer or plate to reduce transfer of vibrations.~~

~~29.~~14. The remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 13 wherein the monitoring unit is not located below the bottom end of the hollow connection shaft.

~~30.~~15. **A smart manhole cover** comprising:

a manhole cover body; and

~~a~~ the remote sensing device as claimed in any one of ~~the previous~~ claims 1 to 14;

wherein the remote sensing device is connected to the manhole cover body such that the antenna unit is located at an upper surface of the manhole cover body and the monitoring unit is located on an underside of the manhole cover body.

~~31.~~16. The smart manhole cover as claimed in ~~the previous~~ claim 15 wherein the elongate connection shaft passes through a through-hole of the manhole cover body for a connection between the antenna unit and monitoring unit~~.~~, and

~~32. The smart manhole cover as claimed in the previous claim~~ wherein the elongate connection shaft extends along a longitudinal connection axis passing through the through-hole~~.~~, and

~~33. The smart manhole cover as claimed in any one of claims 30 to 32~~ wherein the manhole cover body comprises a cavity on the underside of the cover for receiving the monitoring unit and the monitoring unit has a height less than the cavity height such that the monitoring unit does not protrude below a bottom surface of the manhole cover body.

~~34. The smart manhole cover as claimed in any one of claims 31 to 33 wherein the connection comprises one or a combination of the following connection types:~~

~~a) fasteners,~~

~~b) threaded,~~

~~c) snap-on,~~

~~d) twist-fit,~~

~~e) bayonet mount.~~

~~35. The smart manhole cover as claimed in the previous claim wherein the connection comprises a double fastener stack including a primary fastener for first connecting the antenna unit to the manhole cover body and a secondary fastener for connecting the monitoring unit.~~

~~36.~~17. **A method of sensing a parameter** comprising:

providing ~~a~~ the remote sensing device as claimed in any of ~~the previous~~ claims 1 to 14;

monitoring a parameter;

wirelessly communicating data from the remote sensing device to a remote receiver.

~~37.~~18. The method of sensing a ~~condition~~ parameter as claimed in ~~the previous~~ claim 17 further comprising passing the elongate connection shaft through an opening of the monitoring unit and securing the monitoring unit with a hub fastener tightened against a surface of the monitoring unit.

~~38.~~19. The method of sensing a ~~condition~~ parameter as claimed in ~~any one of claims 36 to 37~~claim 17 or claim 18 wherein the parameter is associated with a manhole and the remote sensing device is connected to a manhole cover body to form ~~a~~ the smart manhole cover as claimed in claim~~s 30 to 35~~15 or 16.

~~39. The method of sensing a condition as claimed in the previous claim wherein the elongate connection shaft connects the antenna unit and the monitoring unit on opposite sides of the manhole cover body.~~

~~40.~~20. The method of sensing a ~~condition~~ parameter as claimed in ~~any one of claims 38 to 39~~claim 19 further comprising securing the antenna unit to the manhole cover body before securing the monitoring unit.

~~41. The method of sensing a condition as claimed in any one of claims 38 to 40 further comprising positioning the monitoring unit onto the elongate connection shaft on the underside of the manhole cover body and securing the monitoring unit toward and/or against a bottom surface of the cover.~~

~~42. The method of sensing a condition as claimed in the previous claim wherein the monitoring unit is clamped between the manhole cover body and a nut.~~

~~43. The method of sensing a condition as claimed in any one of claims 36 to 42 further comprising rotating one or both of the antenna unit and the monitoring unit to their operating position before securing the units in position.~~

~~44. The method of sensing a condition as claimed in any one of claims 38 to 43 wherein the antenna unit is secured to the manhole cover body before the monitoring unit is secured to the manhole cover body.~~

~~45.~~21. The method of sensing a ~~condition~~ parameter as claimed in ~~any one of claims 38 to 44~~claim 19 or claim 20 wherein the remote sensing device is retrofitted to an existing manhole cover body.

~~46. The method of sensing a condition as claimed in any one of claims 38 to 45 wherein the remote sensing device is connected to the manhole cover body during manufacture.~~

47.22. The method of sensing a ~~condition~~ parameter as claimed in any one of claims ~~36~~ 17 to ~~37~~ 21 wherein the remote sensing device is associated with and connected to one of the following:

a) sewers,

b) stormwater catch pits,

c) rain gardens,

d) water troughs,

e) gross pollutant traps,

f) waste tanks.