CLAIMS

1. A settling basin of a wastewater treatment system, the settling basin comprising:

a collector chain for driving a plurality of flights through the settling basin, the collector chain including chain links comprising:

a plurality of side bars including an inner pair of side bars and an outer pair of side bars, each of the plurality of side bars shaped as flattened open loops;

stepped connecting pins configured to join the plurality of side bars, each stepped connecting pin including a first end including a head portion having a cross-sectional area larger than apertures defined by interior curved surfaces of end sections of the side bars through which the stepped connecting pins extends and a second end on an opposite end of the stepped connecting pin from the first end and having a cross-sectional area less than the cross-sectional area of the head portion;

end caps configured to receive the second ends of the stepped connecting pins, the end caps including reduced cross-sectional area portions and larger cross-sectional area portions having cross-sectional areas greater than cross-sectional areas of the reduced cross-sectional area portions; and

apertures defined in the end caps and second ends of the stepped connecting pins configured to receive a retaining element.

2. The settling basin of claim 1, wherein the end caps include internal bores configured to receive and retain the second ends of the stepped connecting pins.

3. The settling basin of claim 1, further comprising grooves defined in the larger cross-sectional area portions of the end caps, the grooves configured to receive and retain ends of the retaining elements passing through the end caps.

4. The settling basin of claim 1, wherein each stepped connecting pins further comprise a

stepped portion having a cross-sectional area intermediate of the cross-sectional area of the head portion and the cross-sectional area of the non-stepped portion, the stepped portion configured to be disposed within the apertures of the plurality of side bars.

5. The settling basin of claim 1, wherein each of the plurality of side bars includes inwardly extending projections that extend the interior curved surfaces of the end sections of the plurality of side bars beyond 180º.

6. The settling basin of claim 5, wherein at least one of the stepped connecting pins and end caps include one or more projections configured to engage the inwardly extending projections of the plurality of side bars and suppress relative motion between the stepped connecting pins, end caps, and outer pairs of side bars.

7. The settling basin of claim 1, further comprising shields sized and shaped to align with sides of the plurality of side bars.

8. The settling basin of claim 7, wherein the shields are formed integral with one of the stepped connecting pins andend caps.

9. The settling basin of claim 7, wherein the shields comprise sheets that are retained on outer walls of the plurality of side bars.

10. The settling basin of claim 7, wherein the shields include apertures having recesses sized and shaped to receive radially extending projections disposed on one of thestepped connecting pins and end caps.

11. The settling basin of claim 1, wherein at least one ofthe plurality of side bars includes a strain gauge.

12. The settling basin of claim 11, wherein the at least oneof the plurality of side bars includes a wireless transmitter configured to transmit data from the strain gauge to an external data recorder.

13. The settling basin of claim 12, wherein the at least one of the plurality of side bars further includes a memory configured to retain information related to time in service of the atleast one of the plurality of side bars and the wireless transmitter is configured to transmit the data related to time in service of the at least one of the plurality of side bars to the external data recorder.

14. The settling basin of claim 13, wherein the external data recorder is programmed to issue an alarm responsive the data related to time in service of the at least one of theplurality of side bars being indicative of the at least one of the plurality of side bars approaching or exceeding a rated useful life.

15. The settling basin of claim 12, wherein the strain gauge and wireless transmitter are potted with a water impermeable material at least one of on a surface of the at least one of the plurality of side bars or within a cavity defined in the at least one of the plurality of side bars.

16. The settling basin of claim 12, wherein the external data recorder is programmed to issue an alarm responsive to stress measured by the strain gauge exceeding a predefined level.

17. The settling basin of claim 12, wherein the strain gauge and wireless transmitter are disposed in a portion of a center section of the at least one of the plurality of side bars that is thinned relative to other portions of the center section.

18. The settling basin of claim 11, wherein the at least one of the plurality of side bars is formed of a different material than others of the plurality of side bars.

19. The settling basin of claim 11, wherein the strain gauge includes one of an optical strain gauge and an acousticstrain gauge.

20. The settling basin of claim 1, further comprising at least one sprocket including one of a strain gauge or pressure transducer configured to measure stress applied to the collector chain.

21. The settling basin of claim 1, wherein at least one of the stepped connecting pins includes an internal core having a strain gauge configured to measure stress applied to the collector chain.

22. A collector chain for driving a plurality of flights through a settling basin of a wastewater treatment system,the collector chain including chain links comprising:

a plurality of side bars including an inner pair of side bars and an outer pair of side bars, each of the plurality of side bars shaped as flattened open loops;

stepped connecting pins configured to join the plurality of side bars, each stepped connection pin including a first end including a head portion having a diameter larger than portions of the plurality of side bars through which the stepped connecting pin extends and a second end on an opposite end of the stepped connecting pin from the first end and having a diameter less than the diameter of the head portion;

end caps configured to receive the second ends of the stepped connecting pins, the end caps including reduced cross-sectional area portions and larger cross-sectional area portions having cross-sectional areas greater than cross-sectional areas of the reduced cross-sectional area portions; and

a strain gauge included in at least one of the plurality of side bars.

23. A settling basin of a wastewater treatment system, the settling basin comprising:

a collector chain for driving a plurality of flights through the settling basin, the collector chain including chain links comprising:

a plurality of side bars including an inner pair of side bars and an outer pair of side bars, each of the plurality of side bars shaped as flattened open loops;

shields sized and shaped to align with sides of the plurality of side bars;

stepped connecting pins configured to join the plurality of side bars, each stepped connecting pin including a first end including a head portion having a cross-sectional area larger than apertures defined by interior curved surfaces of end sections of the side bars through which the stepped connecting pins extends and a second end on an opposite end of the stepped connecting pin from the first end and having a cross-sectional area less than the cross-sectional area of the head portion;

end caps configured to receive the second ends of the stepped connecting pins; and

apertures defined in the end caps and second ends of the stepped connecting pins configured to receive a retaining element.