



## DESIGN STATEMENT

**ISSUED BY:** GHD Limited  
(design firm)

**TO:** Christchurch City Council  
(owner)

**IN RESPECT OF:** Stopbank Upgrade Works  
(description of contract works)

**AT:** Avon River Temporary Stopbanks, Christchurch  
(address)

GHD Limited (design firm) has been engaged by Christchurch City Council (owner) to provide design services for:

Upgrade works to the existing temporary stopbanks to bring them up to design level and extend their design life, and construct new sections of stopbank where the existing river bank was below the design level. The works also included the construction of a path on some stopbanks, on portions of the existing stopbank as indicated on the drawings listed below.

I, Allen Ingles, a suitably qualified design professional on behalf of GHD Limited (design firm), confirm that the design has been carried out with due skill, care and diligence as it relates to:

~~All of the design~~ / Part only of the design as described below:  
(delete that which is not applicable)

and I believe on reasonable grounds that the design has been carried out in accordance with the following agreed design philosophy:

In 2016 GHD were commissioned to undertake a risk assessment of the stopbanks (outside of this contract). This was carried out following the Australian National Committee on Large Dams Guidelines (ANCOLD) Guidelines, using a methodology known as Failure Modes Effects Analysis (FMEA). This study considered a number of risk factors which included a design check of the overall stability of the existing stopbanks, based on the typical constructed geometry and materials. The conclusions of this study were that the highest risk to the stopbank performance was from overtopping and degradation of sandbag sections.

To re-establish an appropriate level of flood protection and extend the design life of the existing temporary stopbank system to 20 years, two contracts were awarded, namely:

- a sandbag replacement project using a Terramesh trapezium, and
- a raising of the stopbank (this contract).

### Stopbank Height Design

The design height of the stopbank is based on river and tidal modelling carried out in conjunction with the Christchurch City Council to achieve the following agreed criteria:

- 1 in 50 year ARI, 24 hour event with 200 mm freeboard
- 1 in 100 year ARI, 24 hour event with zero freeboard.

### Stopbank Material and Cross Section Design

The majority of the work was to top-up existing sections of stopbank to the design level, although some sections were raised with Terramesh baskets due to the required height increase and/or space constraints. The typical cross section and materials, as used in the original construction of the temporary stopbanks, were adopted as the design criteria for where stopbanks had to be constructed as part of this contract and the banks were topsoiled and seeded.

The general approach to the stopbank design philosophy was independently peer reviewed by CCC before proceeding with the work. A generic check for stability and bearing capacity was undertaken for the 1(V):3(H) trapezoidal stopbank to validate the existing design at four specific locations. This review confirmed the typical section was stable under the expected ground conditions. The design life for the stopbank upgrade is 20 years.

The works covered by this design statement are described in the drawings listed below together with the specifications. Note that the construction items indicated on the drawings listed does not necessarily represent actual items constructed.

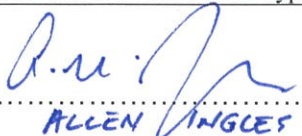
### Drawing List

Drwg No	Drawing Title	Rev
C001	Cover Sheet	0
C002	Drawing Schedule & Distribution List	0
C003	General Notes	0
C004	Sheet Layout Plan	0
C101	True Left Stopbank Plan & Long Section - Sheet 1	0
C102	True Left Stopbank Plan & Long Section - Sheet 2	0
C103	True Left Stopbank Plan & Long Section - Sheet 3	0
C104	True Left Stopbank Plan & Long Section - Sheet 4	0
C105	True Left Stopbank Plan & Long Section - Sheet 5	0
C106	True Left Stopbank Plan & Long Section - Sheet 6	0
C107	True Left Stopbank Plan & Long Section - Sheet 7	0
C108	True Left Stopbank Plan & Long Section - Sheet 8	0
C109	True Left Stopbank Plan & Long Section - Sheet 9	0
C110	True Left Stopbank Plan & Long Section - Sheet 10	0
C111	True Left Stopbank Plan & Long Section - Sheet 11	0
C112	True Left Stopbank Plan & Long Section - Sheet 12	0
C113	True Left Stopbank Plan & Long Section - Sheet 13	0
C114	True Left Stopbank Plan & Long Section - Sheet 14	0
C115	True Left Stopbank Plan & Long Section - Sheet 15	0
C116	True Left Stopbank Plan & Long Section - Sheet 16	0

C117	True Left Stopbank Plan & Long Section - Sheet 17	0
C118	True Left Stopbank Plan & Long Section - Sheet 18	0
C119	True Left Stopbank Plan & Long Section - Sheet 19	0
C120	True Left Stopbank Plan & Long Section - Sheet 20	0
C121	True Left Stopbank Plan & Long Section - Sheet 21	0
C122	True Left Stopbank Plan & Long Section - Sheet 22	0
C123	True Left Stopbank Plan & Long Section - Sheet 23	0
C124	True Left Stopbank Plan & Long Section - Sheet 24	0
C125	True Left Stopbank Plan & Long Section - Sheet 25	0
C126	True Left Stopbank Plan & Long Section - Sheet 26	0
C127	True Left Stopbank Plan & Long Section - Sheet 27	0
C128	True Left Stopbank Plan & Long Section - Sheet 28	0
C129	True Left Stopbank Plan & Long Section - Sheet 29	0
C130	True Left Stopbank Plan & Long Section - Sheet 30	0
C131	True Left Stopbank Plan & Long Section - Sheet 31	0
C132	True Left Stopbank Plan & Long Section - Sheet 32	0
C133	True Left Stopbank Hardy Street Boat Ramp	0
C201	True Right Stopbank Plan & Long Section - Sheet 1	0
C202	True Right Stopbank Plan & Long Section - Sheet 2	0
C203	True Right Stopbank Plan & Long Section - Sheet 3	0
C204	True Right Stopbank Plan & Long Section - Sheet 4	0
C205	True Right Stopbank Plan & Long Section - Sheet 5	0
C206	True Right Stopbank Plan & Long Section - Sheet 6	0
C207	True Right Stopbank Plan & Long Section - Sheet 7	0
C208	True Right Stopbank Plan & Long Section - Sheet 8	0
C209	True Right Stopbank Plan & Long Section - Sheet 9	0
C210	True Right Stopbank Plan & Long Section - Sheet 10	0
C211	True Right Stopbank Plan & Long Section - Sheet 11	0
C212	True Right Stopbank Plan & Long Section - Sheet 12	0
C213	True Right Stopbank Plan & Long Section - Sheet 13	0
C214	True Right Stopbank Plan & Long Section - Sheet 14	0
C215	True Right Stopbank Plan & Long Section - Sheet 15	0
C216	True Right Stopbank Plan & Long Section - Sheet 16	0
C217	True Right Stopbank Plan & Long Section - Sheet 17	0
C218	True Right Stopbank Plan & Long Section - Sheet 18	0
C219	True Right Stopbank Plan & Long Section - Sheet 19	1
C220	True Right Stopbank Plan & Long Section - Sheet 20	1
C221	True Right Stopbank Plan & Long Section - Sheet 21	0
C222	True Right Stopbank Plan & Long Section - Sheet 22	0
C223	True Right Stopbank Plan & Long Section - Sheet 23	0
C224	True Right Stopbank Plan & Long Section - Sheet 24	0
C225	True Right Stopbank Plan & Long Section - Sheet 25	0
C226	True Right Stopbank Plan & Long Section - Sheet 26	0
C227	True Right Stopbank Plan & Long Section - Sheet 27	0
C228	True Right Stopbank Plan & Long Section - Sheet 28	0
C229	True Right Stopbank Plan & Long Section - Sheet 29	0

C230	True Right Stopbank Plan & Long Section - Sheet 30	0
C231	True Right Stopbank Plan & Long Section - Sheet 31	0
C232	True Right Stopbank Plan & Long Section - Sheet 32	0
C233	True Right Stopbank Hockey Lane Access	0
C501	Typical Stopbank Profiles	0
C502	Terramesh Basket Installation Details	0
C503	General Details Sheet 1	0
C504	General Details Sheet 2	0
C505	General Details Sheet 3	0
C601	True Left Stopbank Cross Sections - Sheet 1	0
C602	True Left Stopbank Cross Sections - Sheet 2	0
C603	True Left Stopbank Cross Sections - Sheet 3	0
C604	True Left Stopbank Cross Sections - Sheet 4	0
C605	True Left Stopbank Cross Sections - Sheet 5	0
C606	True Left Stopbank Cross Sections - Sheet 6	0
C607	True Left Stopbank Cross Sections - Sheet 7	0
C608	True Left Stopbank Cross Sections - Sheet 8	0
C609	True Left Stopbank Cross Sections - Sheet 9	0
C610	True Left Stopbank Cross Sections - Sheet 10	0
C611	True Left Stopbank Cross Sections - Sheet 11	0
C651	True Right Stopbank Cross Sections - Sheet 1	0
C652	True Right Stopbank Cross Sections - Sheet 2	0
C653	True Right Stopbank Cross Sections - Sheet 3	0
C654	True Right Stopbank Cross Sections - Sheet 4	0
C655	True Right Stopbank Cross Sections - Sheet 5	0
C656	True Right Stopbank Cross Sections - Sheet 6	0
C657	True Right Stopbank Cross Sections - Sheet 7	0
C658	True Right Stopbank Cross Sections - Sheet 8	0
C659	True Right Stopbank Cross Sections - Sheet 9	0
C660	True Right Stopbank Cross Sections - Sheet 10	0
C661	True Right Stopbank Cross Sections - Sheet 11	0
C662	True Right Stopbank Cross Sections - Sheet 12	0
C663	True Right Stopbank Cross Sections - Sheet 13	0
C664	True Right Stopbank Cross Sections - Sheet 14	0
C665	True Right Stopbank Cross Sections - Sheet 15	0
C666	True Right Stopbank Cross Sections - Sheet 16	0
C667	True Right Stopbank Cross Sections - Sheet 17	0
C668	True Right Stopbank Cross Sections - Sheet 18	0
C669	True Right Stopbank Cross Sections - Sheet 19	0
C701	Ex. Service Actions Wastewater Assets	0
C702	Ex. Service Actions Stormwater Assets	0
C901	Te Ara Otakaro Avon Trail Sheet Layout Plan	0
C902	Te Ara Otakaro Avon Trail Plans 1 And 2	0
C903	Te Ara Otakaro Avon Trail Plans 3 And 4	0
C904	Te Ara Otakaro Avon Trail Plans 5 And 6	0
C905	Te Ara Otakaro Avon Trail Plans 7 And 8	0

C906	Te Ara Otakaro Avon Trail Plans 9 And 10	0
C907	Te Ara Otakaro Avon Trail Plans 11 And 12	0
C908	Te Ara Otakaro Avon Trail Plans 13 And 14	0
C909	Te Ara Otakaro Avon Trail Plans 15 And 16	0
C910	Te Ara Otakaro Avon Trail Plans 17 And 18	0
C911	Te Ara Otakaro Avon Trail Plans 19 And 20	0
C912	Te Ara Otakaro Avon Trail Plans 21 And 22	0
C913	Te Ara Otakaro Avon Trail Plans 23 And 24	0
C914	Te Ara Otakaro Avon Trail Plans 25	0
C920	Te Ara Otakaro Avon Trail Typical Details	0

Signed by  ..... Qualification *NZCE, AMICE, IENG U.K.*  
*ALLEN ANGLES* ..... *ICE Reg 48876360*  
on behalf of **GHD Limited.**

Date 14/05/2019

*Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of \$200,000\*.*

