# Fish Passage Plan (FPP) Change Request Form

**Change Form # & Title**: 19IHR005 – Units 5 & 6 Operating Range Table

**Date Submitted**: May 7, 2019

**Project**: Ice Harbor Dam

**Requester Name, Agency**: Corps NWW

**Final Action:**

**FPP Section**: Table IHR-5. Turbine Unit Operating Range.

**Justification for Change**:

Updates the FPP table of turbine operating ranges with values for Units 5 & 6 as fixed blades.

Currently there is a footnote that defines Units 5-6 restricted range as approx. 13-14 kcfs. This change would add a table of the operating range values with and without screens at project head of 85-105 feet, based on index test results provided by HDC. The restricted range is still approx. 13-14 kcfs.

**Proposed Changes**:

*See following page for Units 5-6 added to Table IHR-5.*

**Comments**:

**Record of Final Action**:

Table IHR-5. Ice Harbor Dam Turbine Unit Power (MW) and Flow (cfs) at ±1% of Peak Turbine Efficiency (i.e., Lower and Upper Limits of 1% Range) and at Operating Limits. a

|  |  |  |
| --- | --- | --- |
| **Project**  | **IHR Units 5 & 6 - with STS** | **IHR Units 5 & 6 - No STS** |
| **Head** | **1% Lower Limit** | **Peak Efficiency** | **1% Upper Limit** | **1% Lower Limit** | **Peak Efficiency** | **1% Upper Limit** |
| **(feet)** | **MW** | **cfs** | **MW** | **cfs** | **MW** | **cfs** | **MW** | **cfs** | **MW** | **cfs** | **MW** | **cfs** |
| **85** | 82.4 | 13,129 | 85.5 | 13,458 | 87.5 | 13,933 | 79.8 | 12,475 | 83.3 | 12,884 | 91.0 | 14,224 |
| **86** | 83.8 | 13,184 | 86.6 | 13,470 | 88.5 | 13,916 | 81.1 | 12,527 | 84.6 | 12,914 | 92.0 | 14,208 |
| **87** | 85.2 | 13,237 | 87.8 | 13,482 | 89.5 | 13,900 | 82.5 | 12,578 | 85.8 | 12,943 | 93.1 | 14,191 |
| **88** | 86.6 | 13,288 | 88.9 | 13,492 | 90.5 | 13,884 | 83.8 | 12,627 | 87.1 | 12,971 | 94.1 | 14,175 |
| **89** | 88.0 | 13,339 | 90.1 | 13,503 | 91.5 | 13,867 | 85.2 | 12,675 | 88.3 | 12,998 | 95.1 | 14,159 |
| **90** | 89.4 | 13,387 | 91.2 | 13,513 | 92.5 | 13,851 | 86.5 | 12,721 | 89.6 | 13,024 | 96.2 | 14,143 |
| **91** | 90.4 | 13,390 | 92.4 | 13,524 | 93.7 | 13,867 | 87.5 | 12,724 | 90.6 | 13,032 | 97.4 | 14,159 |
| **92** | 91.5 | 13,392 | 93.5 | 13,534 | 94.9 | 13,883 | 88.6 | 12,726 | 91.7 | 13,040 | 98.6 | 14,174 |
| **93** | 92.5 | 13,394 | 94.6 | 13,545 | 96.0 | 13,897 | 89.6 | 12,728 | 92.8 | 13,047 | 99.9 | 14,190 |
| **94** | 93.6 | 13,396 | 95.8 | 13,555 | 97.2 | 13,912 | 90.6 | 12,730 | 93.9 | 13,054 | 101.1 | 14,204 |
| **95** | 94.6 | 13,397 | 96.9 | 13,564 | 98.4 | 13,926 | 91.6 | 12,732 | 95.0 | 13,061 | 102.3 | 14,219 |
| **96** | 95.5 | 13,362 | 98.0 | 13,569 | 99.6 | 13,943 | 92.4 | 12,698 | 96.0 | 13,054 | 103.6 | 14,237 |
| **97** | 96.3 | 13,327 | 99.1 | 13,574 | 100.8 | 13,960 | 93.2 | 12,665 | 97.0 | 13,047 | 104.8 | 14,254 |
| **98** | 97.1 | 13,292 | 100.3 | 13,578 | 102.1 | 13,976 | 93.9 | 12,632 | 98.0 | 13,039 | 106.1 | 14,271 |
| **99** | 97.9 | 13,258 | 101.4 | 13,582 | 103.3 | 13,991 | 94.7 | 12,600 | 99.0 | 13,032 | 107.4 | 14,287 |
| **100** | 98.7 | 13,225 | 102.5 | 13,586 | 104.5 | 14,007 | 95.5 | 12,568 | 100.0 | 13,025 | 108.7 | 14,302 |
| **101** | 99.8 | 13,240 | 103.6 | 13,588 | 105.7 | 14,026 | 96.6 | 12,583 | 101.1 | 13,023 | 109.9 | 14,322 |
| **102** | 100.9 | 13,255 | 104.6 | 13,590 | 106.9 | 14,044 | 97.7 | 12,597 | 102.1 | 13,021 | 111.2 | 14,341 |
| **103** | 102.0 | 13,269 | 105.7 | 13,592 | 108.1 | 14,063 | 98.8 | 12,611 | 103.1 | 13,019 | 112.5 | 14,360 |
| **104** | 103.2 | 13,283 | 106.8 | 13,594 | 109.4 | 14,081 | 99.8 | 12,624 | 104.1 | 13,018 | 113.7 | 14,378 |
| **105** | 104.3 | 13,297 | 107.8 | 13,596 | 110.6 | 14,098 | 100.9 | 12,637 | 105.1 | 13,016 | 115.0 | 14,396 |

1. Table values for 1% upper and lower limits derived from March 2007 HDC report, as updated for Units 5-6 in March 2019. Flow (cfs) is calculated as a function of turbine efficiency, project head, and power output (MW). “Operating Limit” is the maximum safe operating point based on cavitation or generator limit (added Feb 2018).
2. Unit 3 is out of service for turbine replacement, currently scheduled for completion in 2020. Table will be revised after completion of U3 turbine replacement and index testing.
3. Units 5 and 6 have fixed blades and a restricted operating range of approximately 13-14 kcfs (based on 2017 U5 and 2019 U6 abbreviated index test). These units will have a restricted operating range until the blade seals are repaired/replaced.