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| **Asian Development Bank** | **Government of Vietnam**  **Ministry of Natural Resources**  **and Environment** |

**TA7629-VIE: Capacity Building for River Basin Water Resources Planning**

**Component 2: Planning Tasks for the Red-Thai Binh River Basin**

**Guidelines on the use of Water Resource**

**Indicators for the preparation of a Status Report for a River Basin**

Prepared for**:**

**The Department of Water Resources Management on behalf of the Government of Viet Nam and the Asian Development Bank**

Prepared by

**AECOM Asia Co. Ltd.**

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**Acknowledgments**

This component of *CDTA 7629-VIE: Capacity Building for River Basin Water Resources Planning* supports the Ministry of Natural Resources and Environment in undertaking activities related to the preparation of planning tasks for the management of water resources of the Red-Thai Binh river basin. Planning tasks are prescribed in the revised Law on Water Resources and precede the formulation of a Water Resources Plan. Planning tasks make prioritised recommendations and a framework for the preparation of river basin planning. The CDTA also aim to develop and pilot a cost-effective framework for formulating planning tasks that could be replicated in other basins of Viet Nam.

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**Limitations Statement**

No warranty or guarantee, whether express or implied, is made with respect to the information reported or to the findings, observations and conclusions expressed in this report. Further, such information, findings, observations and conclusions are based solely upon information in existence at the time of report preparation.

**Guidelines on the use of Water Resource Indicators for the preparation of a River Basin Status Report**

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# Introduction

This report presents the full set of Assessment Indicators developed for *CDTA 7629-VIE: Capacity Building for River Basin Water Resources Planning.* This component of the TA is designed to assist MoNRE in developing a process and tools for the formulation of Planning Tasks as specified under the 2012 Law on Water Resources.

The assessment indicators reported here cover the main areas for conducting a systematic analysis of various water resource related topics to identify key issues facing water management in a river basin. The information developed from the application of the resources will assist planners in understanding the current and projected future condition and use of water resources in a river basin. These results will help develop a status report to support the design of target Planning Tasks to guide subsequent planning activities for water resources planning in a river basin.

The indicators are summarised as follows

(i) Water Resources (18 indicators): quantity, international linkages, dry season effects, water use, water storages, flooding effects, and climate change effects.

(ii) Groundwater (13 indicators): groundwater recharge, availability, water use, water level drawdown, and groundwater quality.

(iii) Economic (12 indicators): GDP, economic structure, sector production (industry, agriculture, irrigation, hydropower, navigation), and economic value for water use.

(iv) Social (13 indicators): population, population structure, poverty, ethnicity, employment, water services (clean water, sanitation), and flood impacts.

(v) Environment (12 indicators): vegetation cover, biodiversity, conservation areas, cultural heritage areas, natural river flows, water quality, and river obstructions.

(vi) Management (16 indicators): basic survey (surface water, groundwater, water quality, environment, licensing, application of Government decisions (Decision 64, Decree 67), use of EIA, inspections, and efficient service provision.

Assessment Indicators are intended to act as a policy tool that can assist with the identification and analysis of key issues that deserve greater attention within national and provincial water management programs. The indicators help to identify sub-basins that are at a critical stage for a particular issue. This information is useful in identifying management priorities, potential options for water resources planning, and issues for each sub-basin that might benefit from increased investment and management attention.

The Indicator Guidelines describe in detail:

1. The name and code for each indicator.
2. How each indicator is defined; and,
3. The interpretations and implications for the planning tasks.

Planners should study these indicators to understand the information that will come from such analysis. Planners should also consider whether additional indicators may be useful to analyse a particular issue in a river basin. Ultimately, the planners must select which indicators they actually wish to use.

For application of these Assessment Indicators, a detailed **Reference Report** has been prepared and is available on the project’s website at [www.vnwaterresources.com](http://www.vnwaterresources.com) or from the Department of Water Resources Management, MoNRE.

# Water Resource Indicators

| **Water resource indicator name & code** | **Description** | **Interpretation** |
| --- | --- | --- |
| **WRI-1**: Sub-Basin water index | The total water volume generated in the sub-basins as a percentage of the total Basin water volume, both within Viet Nam only and including any international component. | It indicates the proportion of the Basin's total water that is generated within each sub-basin. A high percentage indicates a high contribution of surface water from a sub-basin to total water in the basin. |
| **WRI-2**: Sub-basin international dependency water index | The percentage of the total water resources volume generated in the sub-basin that, under current conditions and water use patterns, either comes from another country or flows to another country. | It indicates both the dependence of this sub-basin on water inflows from another country and the dependence of other countries on the water from this sub-basin. Results may indicate a need for an international agreement on water sharing and water quality to protect water security. |
| **WRI-3**: Inter-basin discharge index | The percentage of the total water resources volume naturally generated in the sub-basin (including international inflows and outflows) that, under current conditions and water use patterns, either flows to another sub-basin or comes from another sub-basin. | It indicates both the dependence of this sub-basin on water inflows from another sub-basin and the dependence of other sub-basins on the water from this sub-basin. Results may indicate a need for good water sharing and water quality arrangements between sub-basins. |
| **WRI-4**: Dry season water index | The percentage of the total annual water generated in the sub-basin that is generated in the dry season (including water in Viet Nam and international inflows). | It indicates the percentage of the total annual water volume that is available in the dry season and the length of the dry season. It provides an indication of the stress on the sub-basin during the dry season. A small percentage and a large number of months may indicate that water shortages will be serious with significant conflicts over access to water. |
| **WRI-5**: Dry season international water index | The percentage of the dry season water volume of the sub-basin that (a) comes from another country or (b) discharges to another country. | It indicates both the dependence of the sub-basin on water inflows from another country and the dependence of other countries on the water outflow or discharge from the sub-basin. A high percentage may indicate a need for good international agreements on water sharing and water quality. |
| **WRI-6**: Water Productivity Index | Total natural water volume generated in the sub-basin divided by the sub-basin area for both the full year and the dry season. | It indicates the most productive water generating areas of the basin. A high number may indicate those areas that need to be protected by catchment management activities to ensure they can continue to generate water into the future. |
| **WRI-7**: Water storage share index | Total active reservoir volume in sub-basin as percentage of total active reservoir volume in the RR Basin, both (a) currently and (b) for 2025. | It indicates the significance of the storage volume of this sub-basin compared to the total Basin storage volume. A high percentage may indicate the significance of the sub-basin storage to the basin as a whole. |
| **WRI-8**: Reservoir storage control index | Total active reservoir volume in sub-basin divided by total natural water volume for a sub-basin. | It relates the total reservoir storage volume to the total water volume of a sub-basin, indicating the amount of the water flows in the sub-basin that may be captured in reservoirs and controlled by infrastructure. A high percentage may indicate good flood control potential; but also that river health or the needs of lower river communities may not be met. |
| **WRI-9**: Water storage benefit index | For current and 2025, the total active reservoir volumes in the sub-basin used for hydropower, irrigation and "other" purposes; and the water storage per capita for water security (irrigation, flood mitigation, water supply, etc) and for energy security. | It indicates the predominant use of reservoirs in the sub-basin currently and at 2025, and the water storage per capita in sub-basins which can be compared to international levels. A high ratio of single purpose storages means that generally single objectives are being met. Multi-purpose reservoirs need to be assessed against multiple objectives and may indicate a need to adjust operating rules. |
| **WRI-10**: Infrastructure sub-basin diversion index | The water volume diverted between a sub-basin and other sub-basins using infrastructure as a percentage of the total natural water volume in this sub-basin for (a) the total annual situation and (b) the dry season. | It indicates the percentage of sub-basin natural water volume that is diverted from a sub-basin or is diverted into another sub-basin. A high percentage diverted out indicates a significant amount of water no longer available in this sub-basin with consequential impacts on river health and basin communities. |
| **WRI-11**: Water availability index | Total annual water resources volume generated in the sub-basin divided by (a) current population (Viet Nam only); (b) projected population at 2025 (Viet Nam only). For any sub-basins that depend substantially on through flows from other sub-basins, this includes the through flows and the inter-basin diversions in a separate adjusted assessment. | It relates the total natural water volume to the population (m3 per capita, current and at 2025) and indicates the ability of the natural water resources to support the population now and into the future (based on current natural water which may decline under climate change). This indicates the impact water availability can have on human activity and life. |
| **WRI-12**: Dry season water availability index | Dry season water resource volume generated in the sub-basin divided by: (a) current population (Viet Nam only); (b) projected population at 2025 (Viet Nam only). For sub-basins that depend substantially on dry season through flows from other sub-basins, dry season volumes are adjusted to include through flows, inter-basin diversions, and reservoir storage volumes in a separate adjusted assessment. | It relates the dry season water resources with the population (m3 per capita, current and at 2025) and indicates the ability of the water resources to support the population in the dry season. This indicates the impact water availability can have on human activity and life. |
| **WRI-13**: Water Exploitation index | Proportion of the natural total annual water volume that is exploited and used under: (a) current levels of water demand and use; (b) projected 2025 levels of water demand and use. | It relates water exploitation and use to the natural available water in the dry season, and can identify if abstractions rates are sustainable. A high percentage indicates high stress on the water resources. |
| **WRI-14**: Dry season exploitation index | Proportion of the natural dry season water volume that is exploited and used under: (a) current dry season levels of water demand/use; (b) projected 2015 dry season levels of water demand/use. | It relates exploitation and use to the available natural water and can identify if abstractions rates are sustainable. A high percentage indicates high stress on the water resources. |
| **WRI-15**: Water exploitation per capita index | (a) Current total water use/demands in the sub-basin divided by current population (Viet Nam only); (b) Projected 2025 total water use/demands in the sub-basin divided by projected population at 2025 (Viet Nam only) | It indicates the average total water use per person in the basin at present and projected at 2025. A high figure indicates that water use could be inefficient. This indicates the pressure that water exploitation and use puts on the resource. |
| **WRI-16**: Sector water use index | Percentage of total water use by the major sectors - irrigation, agriculture (livestock), industry, urban, and aquaculture. | It identifies the major uses of water in the basin. A high proportion of water use for irrigation generally means potential for water efficiency gains. |
| **WRI-17**: Flood mitigation storage index | Total reservoir storage volume in the sub-basin used for flood mitigation compared to wet season water volume in sub-basin. | It indicates the relative size of flood mitigation reservoirs in the sub-basin, compared to wet weather water volume in sub-basin. A high ratio means a significant proportion of wet season basin flows could potentially be caught in a reservoir. |
| **WRI-18**: Climate change - temperature index | Percentage increase in the average summer temperature over the recent history compared to that projected for the sub-basin under climate change. | It indicates the projected and relative increase in the average summer temperatures in the sub-basins. A high percentage indicates an increase in evaporation; reduced runoff; and increased demands for water within the sub-basin. |

# Groundwater Indicators

| **Groundwater indicator name & code** | **Description** | **Implications** |
| --- | --- | --- |
| **GWI-1**: Groundwater area index | Size of area for each type of aquifer in sub-basin, and percentage of aquifer type areas in the Basin overall. | It indicates the proportion of the Basin's total area covered by each aquifer type; and also indicates the area of each aquifer type in the sub-basins. A high percentage may indicate the groundwater potential of a sub-basin. |
| **GWI-2**: Groundwater recharge index | Proportion of the Basin groundwater recharge in the sub-basins and the volume of recharge by aquifer type in each sub-basin. | It indicates the proportion of the Basin's total recharge that is provided by the sub-basin and also indicates the recharge capacity of the aquifer types in the sub-basins. A high percentage indicates that a substantial proportion of the Basin's groundwater potential groundwater is provided by a sub-basin. A low percentage indicates that the sub-basin most likely contains little usable groundwater. |
| **GWI-3**: Groundwater recharge potential index | This is the recharge of the aquifer types per land area. | It indicates the types of aquifer that provided the most recharge and their location in the sub-basins. It can show the more important recharge areas which may need to be protected. |
| **GWI-4**: Groundwater exploitation index | Proportion of the Basin groundwater exploitation capacity in the sub-basins; and the exploitation capacity in the aquifer types in the sub-basins | It indicates the proportion of the Basin's total exploitation capacity that is provided by the sub-basin; and also by aquifer types in the sub-basins. A high percentage indicates that a substantial proportion of the Basin's groundwater exploitation capacity is provided by a sub-basin. A low percentage means that the sub-basin may contain little usable groundwater. |
| **GWI-5**: Groundwater sustainability index | Ratio of the exploitation capacity of the aquifer to the natural recharge. | It indicates the proportion of the natural recharge of the aquifer that is exploited and used. A percentage greater than 100% means water is being extracted at greater than the recharge rate, which means that water is being taken from the aquifer storage volume, which many not be replaced. |
| **GWI-6**: Groundwater availability index | Exploitation capacity of the sub-basin divided by divided by: (a) current population (Viet Nam only); (b) projected population at 2025 (Viet Nam only). | It relates the sustainable groundwater to the population (current and at 2025). It indicates the ability of the water resources to support the population now and into the future according to international standards of water stress. |
| **GWI-7**: Overall groundwater use index | Proportion of the total Basin groundwater used within each of the sub-basins. | It indicates the proportion of the Basin's total groundwater use that is supported by the sub-basin. A high percentage indicates that a substantial proportion of the Basin's groundwater use occurs in a sub-basin. |
| **GWI-8**: Groundwater use per sector index | Proportion of the sub-basin groundwater use by the sectors (towns, industrial zones, rural water supply). | It indicates a sector’s dependence on groundwater. A low percentage means that the sector has alternative supplies of groundwater. A high percentage for "other/unknown" means that water use monitoring is inadequate. |
| **GWI-9**: Groundwater use per aquifer | Groundwater use by the sectors (towns, industrial zones, rural water supply) and by aquifer type. | It indicates the sub-basin’s use of groundwater by both sectors and by aquifer type. A high use for any of the sectors may focus the groundwater management effort onto specific aquifer types in localities to protect water supply. |
| **GWI-10**: Future groundwater index | 2025 proportion of the sub-basin groundwater use by the sectors (towns, industrial zones, rural water supply). | It indicates the 2025 proportion of the sub-basin's groundwater use by sector. A high percentage for any of the sectors indicates the dependence of that sector on groundwater in 2025. A high percentage for "other/unknown" means that water use monitoring is inadequate, and is poorly understood. |
| **GWI-11**: Groundwater use and exploitation capacity index | The ratio of groundwater use compared to the groundwater exploitation capacity, under current and 2025 conditions. | It indicates the amount of the assessed exploitation capacity that is required to meet current and projected 2025 water uses. A figure greater that 100% indicates a need to reduce groundwater use and to use water more efficiently; otherwise, groundwater use will be unsustainable and the resource will be mined. |
| **GWI-12**: Area affected by drawdown index | The ratio of the area of the aquifer suffering groundwater level drawdown to the total aquifer area. | It indicates the extent of the aquifer suffering from dropping water levels due to local over-exploitation. A high number indicates significant lowering of water levels. |
| **GWI-13**: Groundwater quality index | The % of the aquifer areas that are subject to saline water and arsenic contamination. | It indicates the significance of saline water and arsenic contamination to the aquifer. A high number indicates that major parts of the aquifer are not suitable for exploitation and use and need careful management to ensure that contaminated water does not move into good quality aquifers. |

# Economic Development Indicator

| **Economic development indicator name & code** | **Description** | **Implications** |
| --- | --- | --- |
| **EDI-1**: Sub-basin GDP Index | Sub-Basin GDP divided by Basin GDP at current prices. | It indicates the significance of the current levels of economic activities of the sub-basin to the Basin economy. A high indicator value means that the sub-basin is significantly contributing to the Basin economy compared to other sub-basins. |
| **EDI-2**: GDP per capita Index | Sub-basin GDP at current prices divided by sub-basin populations. | It indicates the current level of per capita income in the basin and sub-basins. A high indicator value indicates that the sub-basin is contributing significantly to the Basin economy. |
| **EDI-3**: GDP growth index | GDP average growth rate over the last 5 years (at constant 1994 prices). | It indicates the rate of growth of economic output over time. A high percentage indicates strong growth. This may have implications for river health. |
| **EDI-4**: Economic structure index | Percentage of GDP (current prices) provided by agriculture, industry, and services sectors. | It indicates the nature of the economic activity in the basin by sector. This identifies the economic drivers for the sub-basin and potential impacts of economic activities on water resources. |
| **EDI-5**: Industry sector production index | Value of industrial production divided by the water used for industrial activities. | This indicates the economic value of industrial production per unit of water used for industrial activities. A high indicator value indicates a sub-basin with relatively greater economic returns from industrial production per unit of water input compared with the other sub-basins, but not necessarily more efficient use of water. NOTE: This indicator ascribes 100% of industrial output value to water, which will over estimate the value of water as all other inputs to industry are excluded. |
| **EDI-6**: Irrigation sector production index | Value of irrigation production divided by the water used for irrigation activities. | This indicates the value of irrigation production per unit of water used for irrigation activities. This will generally include both surface water and groundwater, as they are difficult to separate. A high production value per unit of water use may indicate more efficient use of water. NOTE: This indicator ascribes 100% of irrigated agricultural output value to water, which will over estimate the value of water as all other inputs are excluded. |
| **EDI-7**: Irrigation development index | Proportion of the design area of irrigation schemes that is currently irrigated. | It indicates the current development of irrigation schemes compared to their design potential. A high percentage indicates systems are operating relatively effectively. |
| **EDI-8**: Current hydropower generating capacity index | Current hydropower generating capacity as a proportion of the total hydropower generating capacity of the Basin. | It indicates the percentage of the current generating capacity of the sub-basin to the Basin's total hydropower production. A high percentage indicates that this sub-basin is providing a significant contribution to the Basin hydropower generating capacity. |
| **EDI-9**: Future hydropower index | Projected hydropower capacity of the sub-basin at 2025 as a proportion of the projected total Basin hydropower at 2025. | It indicates the percentage of the 2025 generating capacity of the sub-basin to the Basin's total hydropower production. A high percentage indicates that a sub-basin will provide a significant contribution to the Basin hydropower generating capacity. |
| **EDI-10**: Hydropower development index | Proportion of the full potential for hydropower development of the sub-basin currently developed, and developed at 2025 projections. | It indicates how much of a sub-basin’s full potential is currently developed and is projected to be developed in 2025. A high percentage indicates that the hydropower development of this sub-basin will approach the maximum full development potential. This may have environmental consequences for the river system. |
| **EDI-11**: Navigation index | Economic value of inland cargo for the sub-basin as a proportion of total for Basin. | It indicates the economic values of the current sub-basin waterway transportation as percent of total for Basin. |
| **EDI-12**: Aquaculture index | Economic value of aquaculture divided by the water used for aquaculture production. | It indicates the economic returns from the current use of water devoted to aquaculture. A high number indicates a good return for investment in aquaculture production. |

# Social Development Indicators

| **Social indicator name & code** | **Description** | **Implications** |
| --- | --- | --- |
| **SDI-1**: Basin population Index | The sub-basin population as percentage of the Basin population, both current and in 2025. | It indicates the proportion of the Basin population that lives in the sub-basin, both current and in 2025. The higher the percentage, the greater the significance to the Basin in terms of putting pressure on the water and related natural resources. |
| **SDI-2**: Population growth index | Percentage of population growth experienced in the basin. | It indicates the growth of the population. A high percentage suggests a faster growing population and therefore greater potential impacts on the basin. |
| **SDI-3**: Population density index | Basin population divided by the basin area. | It indicates the pressure on the river basin from the density of people. A high percentage suggests greater potential impacts on the basin. |
| **SDI-4**: Rural urban index | Ratio of the population in rural and urban areas. | It indicates the percentage of the population that lives in urban and rural areas and, therefore, the level of water services they may require. |
| **SDI-5**: Poverty number index | The number of people in the sub-basin community assessed as living in poverty, and the percentage of households. | It indicates the number of people and households in poverty in the sub-basin. A high number suggests that many people in the basin live in extremely poor conditions, which affect access to safe food, safe water, and clean sanitation. |
| **SDI-6**: Ethnic minority index | The percentage of ethnic minority people in the total population. | It indicates a need for provision of water services and also the degree of difficulty in providing services. A high percentage suggests that this basin may need special consideration for provision of water services. |
| **SDI-7**: Employment index | Percentage of peopled employed in agriculture, industry, and services sectors. | It indicates the ratio of people working in the main economic sectors - this can be related to water used and GDP. A high percentage indicates relative importance of a sector for employment in the sub-basin. |
| **SDI-8**: Unemployment index | Percentage of people unemployed | It indicates the ratio of people without a job and therefore who live in difficult circumstances. A high percentage suggests that this basin may need special consideration for pro poor developments. |
| **SDI-9**: Urban clean water index | The proportion of people with access to clean water in urban areas at Central city and Provincial level. | It indicates the % people having access to clean water in urban areas, at different levels. A high percentage indicates good access to essential services. |
| **SDI-10**: Rural clean water index | The proportion of people with access to clean water in rural areas. | It indicates the % people having access to clean water (according the Health standards) in rural areas and the nature of that access. A high percentage indicates good access to essential services. |
| **SDI-11**: Urban sanitation index | The proportion of people with access to sanitation in urban area. | It indicates the access people have to sanitation services in urban areas in the sub-basin, at different levels. A high percentage indicates good access to essential services. |
| **SDI-12**: Rural sanitation index | The proportion of people with access to sanitation in rural areas. | It indicates the percentage of people having access to sanitation services in rural areas, and the nature of that access. A high percentage indicates good access to essential services. |
| **SDI-13**: Flood damage index | Total cumulative flood damages in the sub-basin over the previous 10 years as a % of sub-basin GDP | It indicates the damages to the sub-basin community from natural hazards and severe flooding. A high percentage indicates that a large proportion of the community is regularly exposed to severe flooding. |

# Environment Indicators

| **Environment indicator name & code** | **Description** | **Implications** |
| --- | --- | --- |
| **EVI-1**: Land use index | Proportion of land area in basin used for forests, agriculture, residential, special purposes, and other. | It indicates the way the basin land is being used. A high percentage for forests suggests that a sub-basin has good water retention capability and a less modified environment. |
| **EVI-2**: Native forest index | Native forest area as percent of Sub-basin area; Sub-basin native forest area as a percent total native forest area. | It indicates the percentage of remaining native forest and the quality of forest cover. A high percentage indicates good quality natural forests and good catchment processes. |
| **EVI-3**: Species index | Number of species in Red Book found in basin. | It indicates the significance of the basin for overall bio-diversity. A high number suggests a need for special protection as it makes a significant contribution to national bio-diversity. |
| **EVI-4**: Conservation area index | Area of national parks, significant wetlands or other conservation areas as a percentage of sub-basin area and of the Basin total. | It indicates the level of conservation provided by the sub-basin. A high percentage suggests that there are large areas of special conservation value and environmental assets in the basin. |
| **EVI-5**: Natural flow index | The proportion of the basin area that is located above major dams | It indicates the percentage of sub-basin area above storages. A high percentage indicates a high level of surface runoff can be captured by dams and regulated, which suggests a low degree of natural river flows in the basin. |
| **EVI-6**: River obstruction index | Ratio of the lengths of river upstream of river structures to the total length of the main rivers in basin | It indicates the percent of the length of river affected by a fixed blockage across the river. A natural river with few structures will have a low number. A high number indicates long lengths of river above a fixed blockage. This will restrict movement of aquatic fish/animals. It will also reduce navigation passage. |
| **EVI-7**: River level index | The current annual minimum river height level at key sub-basin locations compared to the past level (preferably 10 years ago). | It indicates the drop in river height over 10 years and, therefore, the amount of reduced dry season flows in the rivers of the sub-basin. A low index value means that the current water level is much lower than it used to be, resulting in less water for allocations, reduced navigation passage, possible non supply to some users if the current flow levels are below the off-take levels of the supply channel, and significantly reduced river health. |
| **EVI-8**: Biological water quality index | Ambient water quality for BOD5 divided by the corresponding values (Class B) - QCVN 08: 2008/BTNMT National technical regulation on surface water quality. | It is the recorded BOD level divided by the Standard. BOD indicates the amount of organic pollutants found in surface water. A high score indicates low in dissolved oxygen, which can lead to increased release of phosphorus from sediments that can fuel algal blooms. |
| **EVI-9**: Domestic wastewater treatment index | For domestic wastewater, the proportion treated and the level of treatment (primary and secondary). | It indicates the proportion of domestic wastewater treated before discharge, and the level of treatment. A low score for domestic wastewater, and a low secondary score, indicates a high potential for pollution and the addition of organic or other pollutants to the water source. |
| **EVI-10**: Hospital wastewater treatment index | For hospital wastewater, the proportion treated and the level of treatment (Primary and secondary). | It indicates the proportion of wastewater treated before discharge and the level of treatment. A low score for hospital wastewater, and a low secondary score, indicates a high potential for pollution and the addition of organic or other pollutants to the water source. |
| **EVI-11**: Industrial wastewater index | For industrial wastewater, the proportion treated and the level of treatment (Primary, secondary, and tertiary). | It indicates the proportion of wastewater treated before discharge and the level of treatment. A low score for industrial wastewater, and a low T score, indicates a high potential for pollution. |
| **EVI-12**: Solid waste index | The % of solid waste that is collected and disposed of in urban and rural areas. | It indicates the proportion of solid waste that is collected and not simply dumped at random. A low percent indicates a high potential for pollution as most solid waste is dumped near water sources, and/or can find its way to a river, lake or groundwater. |

# Water Management Indicators

| **Water management indicator name & code** | **Description** | **Implications** |
| --- | --- | --- |
| **WMI-1**: Recorded streamflow index | The number of Level 1 gauging stations (National) in the sub-basin, and the number of years of record at the station with the most years. | It indicates the extent of recorded river flow information in the sub-basin. The higher the number, the greater the level of confidence that can be held in the assessment of river flows. |
| **WMI-2**: Overall groundwater assessment index | The percentage of total area of aquifer in sub-basin assessed in each class (A, B, C). | It indicates the level of assessment of the aquifer providing an understanding of the reliability of the information provided from the aquifer. A high percentage for Class A indicates a high level of assessment that can be used for detailed project planning. A high percentage for Class C indicates only a general understanding of the aquifer and information for general planning only. |
| **WMI-3**: Monitoring bore index | Number of National level monitoring bores per sub-basin, and the number of years of record at the bore with the most years. | It indicates the extent of recorded groundwater information in the sub-basin. The higher the number, the greater the confidence in the assessment of groundwater resources. A high number in an area not suffering from over-exploitation of pollution may be a poor investment. On the other hand, a low number in areas where water tables are dropping, or where there is a growing area of saline water, will show poor management decisions. |
| **WMI-4**: Environmental monitoring index | The number of installed sites for monitoring water quality and ecological health. | It indicates the potential for assessing the overall health of water sources in the basin and to assess the impacts of human activities. The higher the number the greater the potential to properly assess water source health. |
| **WMI-5**: Central licensing index | The number of licenses for the basin issued by MoNRE for surface water extraction, groundwater extraction, and wastewater discharge. | It indicates the extent of licensing activity for the Basin undertaken at the central level for major licenses. The higher the number the greater the likelihood that major impacting activities are coming under regulatory control. |
| **WMI-6**: Provincial licensing index | The number of licenses for the basin issued by Provinces for surface water extraction, groundwater extraction, and wastewater discharge. | It indicates the extent of licensing activity for the Basin undertaken at the provincial level. The higher the number the greater the likelihood that major impacting activities are coming under regulatory control. |
| **WMI-7**: Decision 64 Index | The number of pollution establishments listed in Decision 64 that have been completed, are in the process of treatment, or have not yet been dealt with. | It indicates progress in moving on the Decision 64 requirements. A high “completed” or “in process” number means that provinces in the basin have moved to deal with polluting establishments. A high “not yet” number means that provinces have not moved significantly to meet the requirements of the Decision. |
| **WMI-8**: Pollution fees index | The total value of pollution fees collected under Decree 67/2003 and the proportion of this from urban and industrial polluters. | It indicates the use of economic tools for pollution control, particularly for industry. A high value generally means that pollution fees are being levied by the Provinces. A low industrial value means that most of the fees are being set on urban water users and not many industries are exposed to economic tools. |
| **WMI-9**: Urban pollution fee rate index | The total value of pollution fees collected under Decree 67/2003 from urban centers divided by the urban population | It indicates the scale of the financial impact of the pollution fees per person, which can be used to compare sub-basins. A high level of revenue means that fees are likely being levied effectively by the Provinces. However, a low value per person means that Provinces are not using the economic instruments effectively. |
| **WMI-10**: EIA index | The total number of EIA reports (Re) assessed and approved and the number of registration forms issued to establishments that achieve environment standards. | It indicates the number of establishments that have been subject to assessment by the regulatory authorities. A high value means that enterprises that may have a significant effect on the environment have been assessed by specialists and approved. |
| **WMI-11**: Industrial zone EIA index | The number of Industrial Zones; and the number with EIA reports (Re) assessed and approved. | It indicates the number and proportion of Industrial Zones that have been subject to assessment by the regulatory authorities. A high number with EIA reports means that most Industrial Zones have been assessed by specialists and approved. |
| **WMI-12**: Inspections index | The average number of inspections a year compared to the number of EIA reports and licenses issued in the sub-basin. | It indicates the extent to which the regulatory authorities inspect businesses to ensure compliance. A high number of inspections, compared to EIA reports and licenses issued, indicates there are regular inspections for compliance with conditions. |
| **WMI-13**: Urban cost recovery index | The percentage of the average yearly costs of urban water services that are recovered through revenue. | It indicates the cost recovery level for urban water services and the potential for financial sustainability. A high percentage means that subsidization is minimal, consumers are receiving proper price signals and service provision is increasingly sustainable. |
| **WMI-14**: Urban water efficiency index | The percent of water losses in the supply system. | It indicates the percentage of Unaccounted For Water (losses) and the efficiency of service delivery. A high percentage means that significant proportions of high cost treated water are lost in the system and a significant revenue loss. |
| **WMI-15**: Water resources management human capacity index | The number of people working on water resources management per 1 million people in the sub-basin. | It indicates the extent of human resource capacity in the sub-basin engaged in water resources management. A high number indicates better capacity to manage natural resources effectively and to respond to any major issues as required. A low number means that there is little chance that IWRM principles are being applied. |
| **WMI-16**: Water resources management investment capacity index | The value of the state/provincial budget applied to water resources management per sq. km of sub-basin area. | It indicates the extent of financial resource capacity in the sub-basin used for water resources management. A high number indicates good financial resources to manage natural resources on a sustainable basis and to respond to any major issues as required. A low number means that there is little chance that IWRM principles are being applied. |