PUB ACTIVE, BEAUTIFUL, CLEAN WATERS

SECONDARY

Learning Trail

@Lower Seletar Reservoir

TRAINER'S GUIDE

For more information, please visit us at www.abcwaterslearningtrails.sg
or email us at PUB_Learning_Trails@pub.gov.sg.

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Objectives of the Active, Beautiful, Clean (ABC) Waters Learning Trail @ Lower Seletar

This place-based inquiry experience aims to help students:

1. Foster a sense of national identity, pride as Singaporeans, and emotional rootedness to the nation.

2. Learn about the Singapore Water Story vis-a-vis Lower Seletar Reservoir. Appreciate Singapore's unique challenges, constraints, and where we have succeeded.

3. Develop leadership skills, instilling core values and the will to prevail, to ensure Singapore's continued success.

4. Understand PUB's ABC Waters Programme which will transform Singapore's pervasive network of drains, canals and reservoirs into beautiful and clean streams, rivers and lakes. By integrating the streams, rivers and lakes with the parks and gardens, new community spaces can be created. These will be bustling with life and activities, and transform Singapore into a City of Gardens and Water, a vision outlined by Singapore’s Prime Minister Lee Hsien Loong.

5. Evoke a sense of wonder towards innovations, as students understand water treatment processes that give us clean water.

6. Promote stewardship for our strategic water resource and the need for everyone to play a part to keep our waterways and reservoirs active, beautiful and clean.

Details of the ABC Waters Learning Trail @ Lower Seletar

Level	Lower Secondary Students (13 – 15 years old)
Programme Duration:	3 hours
Ratio of Facilitator to Students:	1 : 10 – 20 students
Recommended Maximum Group Size:	80 students (or 2 classes)

Before the Trip:

- Show students and teachers the preparation brief in Annex 1 to help them prepare. Print these only if necessary.
- Fill in the information required for your Risk Assessment Management (RAM) form. Some information is given in Annex 2.

See Pg 8 for more information on how to conduct the Learning Trail.

Educational Approaches

This trail uses inquire-based and experiential learning.

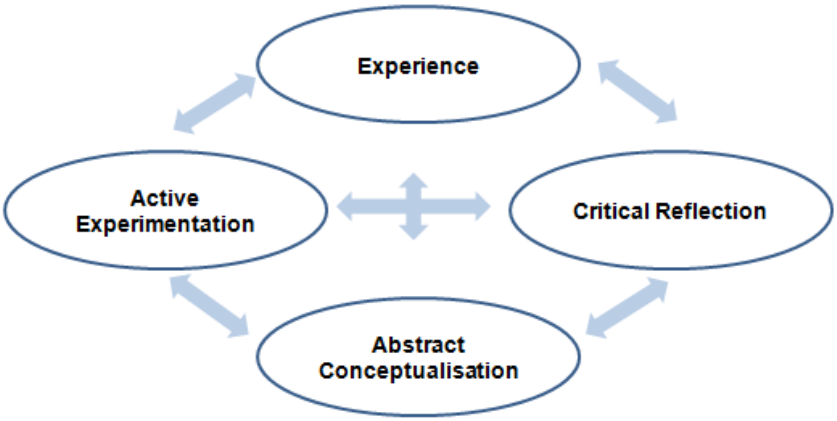
What is Inquiry-Based Learning?
The inquiry-based approach focuses on student constructed learning, as opposed to teacher or guide-transmitted information.

This process aims to enhance learning through:
1. Increased student involvement
2. Multiple ways of knowing

This is achieved by:

- Starting with an open-ended question or demonstration.
- Gather responses and subsequent questions from students with little comment or direction.
- Requiring students to collaborate on designing experiments or methods of inquiry.

What is Experiential Learning?
Experiential learning is the process of making meaning from direct experience.



Before the Trip

- Brief students on the field trip and what to bring and wear. Refer to Annex 1.
- To prepare students, show students the Pack List (Annex 1). Assign students to carry/be in charge of equipment/materials.
- Conduct a reconnaissance of Lower Seletar and familiarise yourself with the area and stations.
- Fill in the Risk Assessment Management (RAM) form required by Ministry of Education (MOE). Suggested information is given in Annex 2.
- Inform the relevant authorities – PUB and NParks and make a booking for your school visit.

Wet Weather Procedure

On the day of the field trip:

- Check the weather forecast and lightning status 1 to 2 hours before the Learning Trail begins:
  - Visit the National Environment Agency website www.weather.gov.sg
  - Dial the lightning advisory number at 6282-6281
- If there is a heavy downpour or the Lightning Category 1 is still not cleared:
  - Do not start the trail
  - Take shelter at the fishing jetty and conduct the extended learning activity on Pg 19 of the student booklet
- If lightning or heavy rain persists, stop the programme and plan for another make-up session if possible.
- Should a storm be expected during the Learning Trail, bring students back to the sheltered area at the fishing jetty as soon as possible. If it is impossible to reach the jetty in time, students should wait under shelters along the trail and move back to the shelter at the fishing jetty as soon as they can. Conduct the line debating activity at the fishing jetty.

Summary of the ABC Waters Learning Trail @ Lower Seletar

Station	Duration	Location	Main Points	Subject Links (See Annex 3 for details)	Page No.	Materials
-	20min	Family Bay Water Play Area	**Introduction** • Introduce the ABC Waters Learning Trail at Lower Seletar Reservoir. • Make the connection between knowledge of water sustainability acquired from school and the ABC Waters Programme. • Enhance map skills by locating the general position and bearing of Lower Seletar Reservoir on the map. • Familiarisation with the learning stations.	**Geography** • Managing our water resources • Map skills: the use of compass to locate a place and directions	1-4	Student booklets, optional: compass

1	35min	Viewing Gallery at the end of the Heritage Deck	**ABC Waters Programme**
			• Understand the concept of ABC Waters Programme that integrates the ecology (green), hydrology (blue) and the community (orange) in our environment.
			• Appreciate and enjoy the beautiful living spaces created by ABC Waters Programme through the following ways:
			  ○ Use descriptive adjectives to capture the scene.
			  ○ Photographing and designing a post card for a friend or for a blog. Describing a student's personal feelings and thoughts of Lower Seletar Reservoir.
			  ○ Writing an ode to Lower Seletar Reservoir.
				Geography
				• Sustaining the urban environment
				
				English Language and English Literature
				• Descriptive vocabulary
				• Descriptive writing
				• Poetry appreciation
					5-6	Student booklet, group scoring sheet, digital or mobile phone camera

Station	Duration	Location	Main Points	Subject Links (See Annex 3 for details)	Page No.	Materials
2	35min	Heritage Panels along the Heritage Deck	**A Walk Down History** • Recount historical events at Sungei Seletar up to present day Lower Seletar Reservoir. • Compare and contrast past and present environment and activities in Lower Seletar. Give reasons for the changes. • Develop appreciation for Lower Seletar's heritage and culture through the ABC Waters Learning Trail at Lower Seletar Reservoir.	**History** • History and culture of a place in Singapore **Geography** • Changing environment in Singapore **English Language** • Reading and comprehension	7-8	Student booklet, group scoring sheet
3	20min	Fishing Jetty	**The Water Cycle and Journey of Water from Lower Seletar Reservoir** • Describe the hydrological cycle in Lower Seletar and its importance to Singapore's water catchment. • Identify the water treatment processes in Lower Seletar and its functions. **Water Quality Testing** • Collect water samples to test for its quality following standard parameters. • Emphasise the importance of good quality water for all forms of life to survive.	**Geography** • Weather studies in particular rainfall and processes in water cycle **Science** • Water cycle and water treatment processes • Process skills • Water quality testing – pH level, dissolved oxygen, turbidity, etc	9 10-11	Student booklet, group scoring sheet Pail, rope, data logger with temperature, pH and dissolved oxygen sensors, turbidity discs, and a water container
4	20min	Litter Trap in the Canal	**Keeping Lower Seletar Active, Beautiful and Clean** • Identify the impact of human activities on our waters and biodiversity. • Identify the pollutants, sources and their impact on the water. • Suggest ways to minimise the negative impact of these activities.	**Geography and Science** • Sources of pollution and its impact • Conserving and protecting our environment	12-13	Student booklet, group scoring sheet

Station	Duration	Location	Main Points	Subject Links (See Annex 3 for details)	Page No.	Materials
5	20min	Rain Garden / Bio-retention swales	**ABC Waters Design Features** • Comprehend the functions of rain garden located at Lower Seletar Reservoir as a natural way to collect, detain and treat rainwater runoff that flows from the park. • Identify the components that make up the rain garden. • Acknowledge its benefits to the environment and the promotion of biodiversity. • Learn about the bioretention swales present at Lower Seletar Reservoir carpark as well.	**Science** • Biodiversity of plant and animal life **Geography** • Conservation of the environment, in particular animal habitat	14-17	Student booklet, group scoring sheet
-	30min	Family Bay Water Play Area	**Debrief and Reflection** **Optional: Reinforcement Activity – Our Precious Waterways** Reinforce through the game: • The ABC Waters Programme that promotes an active, beautiful and clean environment for all to enjoy as a community. • The bill of health of our waterways and reservoirs depends on the community to look after them. • To take pride in our waterways and reservoirs and protect them as a sense of ownership of our environment.	**National Education** • No one owes Singapore a living	18	Student booklet, trainers" guide, group scoring sheet, plastic bags and six to seven numbers of pails.
Total Duration: 3 hours						
EXTENSION ACTIVITY						
-	60min	As preferred	**Line Debating Activity**	**English Language**	19	Student booklet

Conducting the Learning Trail @ Lower Seletar

Overview

The trail will be conducted using an Amazing Race game concept. This will create an interactive and enjoyable learning environment for students to embark on cooperative and collaborative learning.

Recommended Number of Participants

The recommended number of facilitators or teachers is five. Each facilitator or teacher will manage a learning station according to the subject area of expertise or familiarity.

Before the Trail – Group of Students and Role Assigning

The following preparation should be done before the actual trail to avoid utilising the actual trail time.

a) Grouping of students

Form groups of minimum size of six and maximum of eight students per group to facilitate discussions within a group for each station.

b) Group roles

Leader – Overall in charge of facilitating the group. He/she will ensure that the group carries out instructions given during the trail and completes all the station activities satisfactorily. He/she will present group answers during sharing. He/she can engage the assistant to help with the presentation.

Assistant – Helps to implement the leader's instructions.

Two-three Script Writers – They will write the information down during group discussions.

Stationery or Logistics Personnel – Collects booklets, stationery, materials for the game, etc.

Time Keeper – May seem simple but this is the most difficult job of keeping the group on task when running around. The student has to prevent members from wasting time by side-tracking during the trail or at the station. The time keeper has the onus of ensuring that the given time is kept at every learning station and reminding the facilitator when the latter has exceeded the time allocated for the task.

Do allow students to choose their group members and the assigned roles. Should there be difficulty in doing this, a facilitator, preferably a teacher who knows the class well could assist with the grouping.

Teacher's/Trainer's Roles

The teacher/trainer should conduct the planned activity as close as possible to the ABC Waters Trail package. The trainer's guide includes:

- Instructions on how to implement all the suggested activities.
- Suggested questions with answers that serve to elicit focus on either a learning point or to arrive at a conclusion.
- Questions from the student's booklet with answers.

Endorse students' work with the stickers/stamp when they complete the activities in your assigned learning station. This can be done on the individual group score sheet.

On the Day of the Trail – Instruction for the Amazing Learning Trail

- Introduce and brief students on the ABC Waters Learning Trail at Lower Seletar and the five learning stations with the aid of the learning trail booklet from Pg 1-4.
- Explain to students that they will be covering the stations the Amazing Race style.
- Get the leader of each group to draw lots for the name of the group and allocated route for the trail. Each group has a different route and starting point. This is to ensure that every station has only one or at most two groups per station.
- Highlight the fact that each group is named after our catchment areas written on their group score sheet. Refer to group score sheet Pg 38-42.

Explaining the Amazing Learning Trail to Students

Students are to move from one station to another following the given planned route found in the score sheet within 2 hours.

a) At each station students are to participate in the learning activity conducted by the facilitator.
b) All activities must be completed to their best abilities and meet the station master's (i.e. the facilitator's) satisfaction.
c) On completion of the activities for each station, the group will receive a score indicated by the number of stars. The number of stars issued will be according to how responsive and participative they are.
d) They must finish all the stations regardless of whether they finish on time or otherwise. No stations must be skipped.
e) Should any group find that another group is hoarding up on their next designated station; the former could opt to go to an empty station first and come back to their planned route later.
f) Timing is important. If students exceed the total time of 2 hours, 5 marks will be deducted from the group's total score. This is to prevent side tracking and students losing focus along the way.
g) Special bonus – The first group to complete the race within the prescribed time will be awarded five additional points, the second group will be awarded three points and the third group will be awarded one point to their overall group total score. The leader will then add up the score to be written in the grand total column of their group score sheet.

For Teachers and Facilitators – How to use the Group Score Sheet

- At every station, each group will be awarded points according to their level of participation and the points will be totalled up at the end of the reinforcement activity, which is a water game.
- The facilitator will endorse his/her approval by sticking one, two or three star stickers to reward the group for their level of participation. Paste the stickers in the activity column of the score sheet according to the learning station. Instead of using stickers, a cheaper alternative is to write satisfactory, good or very good in the activity column.
- Each stamp or coloured sticker indicates different points, namely:
  - Very good : 3 stickers – 5 points
  - Good : 2 stickers – 4 points
  - Satisfactory : 1 sticker – 2 points
- At the end of the trail, check the score sheets to ensure that the leaders have correctly added up the grand total and select the winning team for the trail.

Lesson Plan for the ABC Waters Learning Trail @ Lower Seletar

Introduction

Duration: 30min
Location: Family Bay Water Play Area
Learning Points:

- Introduce the ABC Waters Learning Trail at Lower Seletar Reservoir
- Make the connection between knowledge of water sustainability acquired from school and the ABC Waters Programme
- Enhance map skills by locating the general positions and bearing of Lower Seletar Reservoir on the map
- Familiarise themselves with the learning stations

Trainer's Notes	Cross Reference/ Materials

1. Welcome and Briefing
• Greeting. Distribute booklet.
• Ask if students are familiar with ABC Waters Programme and Learning Trail Lower Secondary by eliciting from students through questioning.
• Explain meaning of ABC Waters – **Active, Beautiful, Clean** Waters
• Key questions to ask and explain pertaining to highlights of ABC Waters Programme:
  ○ What does ABC Waters Programme aim to achieve with all our catchment and waterways?
  ○ How is this being done?
  ○ Using Lower Seletar as an example, introduce the site.
 	
2. Discover Lower Seletar
• Highlight key points of the ABC Waters Programme in Lower Seletar from the booklet.
• The questions below touches on the key point of the ABC Waters Programme at Lower Seletar.
• Question to ask:
  ○ When was the ABC Waters Project at Lower Seletar opened? (June 2010)
  ○ What are the key features found at Lower Seletar Reservoir? (Family and Rower's Bays)
  ○ What activities can be carried out there? (**Rower's Bay** – Competitive rowing activities like dragon boat race. **Family's Bay** – A place to watch the activities in the reservoir and enjoy the view. Children can play in the wading area. **Heritage Deck** – Revisit the history of the place and a good place to appreciate the view of the reservoir.)
 	
3. Introduction and the Singapore Water Story
• Students to refer to the introduction section and water story pages.
• Briefly explain the aims of the learning trail to students in relation to our water
	Pg 1

story and sustainability.
• Questions to ask:
  ○ Do you know what our four main taps for water are? (Elicit answers from students)
  ○ Besides the four taps to sustain a continuous water supply, what are the other strategies that have been adopted to manage our waters?
• Conduct a simple group quiz to ascertain students' prior knowledge of the four national taps and local catchment areas. If prior knowledge is missing, discuss answers to provide the knowledge.
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4. **Reservoirs in Singapore**
• Finding the location of Lower Seletar Reservoir.
  ○ Refer students to the catchment map of Singapore.
  ○ Students give the location of Lower Seletar Reservoir. Give compass direction for e.g. North-east of Singapore
  ○ Use map in booklet to show location and relate the distance and direction of Lower Seletar from their school.
  ○ Optional activity – To enhance accurate map reading skills, students could take the bearing of Lower Seletar from their school. Demonstrate to students bearing skill in case they have forgotten.
  ○ Use signage map to show the location of the surrounding areas.
	Pg 3
	
	Stationery – Ruler, pencil and protractor

5. **Navigate Lower Seletar Reservoir**
• Familiarise students with the learning station(s).
• With the aid of the site map in the booklet, name and explain the different learning activity for each station:
  ○ *Heritage Deck Viewing Gallery* – Appreciate the beauty with words, photo taking and postcard designing and creative poetry writing.
  ○ *Heritage Deck Heritage Panels* – Learn the history of Lower Seletar Reservoir.
  ○ *Fishing Jetty* – Describe the water cycle and loop.
  ○ *Rain Garden / Bioretention Swales* – The natural way to clean our waters.
  ○ *Family Bay* – Treasure hunting for signage.
  ○ Water games at the water playground.
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6. **Conducting the Trail** • Brief students on hoe the trail is to be carried out – independently without a guide to follow them around. • There will be a facilitator at every station to conduct the learning activity, attend to queries and discuss answers on learning points in the booklet. • However, Learning Trail will be postponed or stopped halfway should there be any change of weather for the worst. • For details, refer to how to conduct the trail in Trainer's Guide.	Pg 7 (of Trainer's Guide)

Station 1: Heritage Deck – Viewing Gallery

Duration: 35min
Location: Heritage Deck Viewing Gallery
Learning Points:

- Understand the concept of ABC Waters Programme of integrating ecology (green), hydrology (blue) and the community (orange) in the Singapore environmen
- Appreciate and enjoy the beautiful living spaces created by ABC Waters Programme through the following ways:
  - Using descriptive adjectives to capture the scene
  - Photographing and designing a post card for a friend or for a blog and describing their feelings and thoughts of the place
  - Writing an ode to Lower Seletar Reservoir

Trainer's Notes	Cross Reference/ Materials

1. ABC Waters Programme
• Facilitator focuses on the beauty aspect of this Learning Trail by asking students questions from the booklet.
• Facilitator will explain the ABC Waters concept – that is to link ecology, hydrology and community in the environment with the aid of the diagram and notes found in the booklet.
• Elicit from students how they think this place will benefit them and the community. Use the questions found in the booklet to do this.
• Allow them to share the benefits of this programme for themselves as well as to the community.
 	
2. How has the ABC Waters Programme by PUB benefited the community living in the area and yourself?
Suggested answers:
• Water Supply
  ○ It serves as one of the national taps for water supply. The natural water features you see are designed to keep our waters clean before they enter our reservoirs.
• Recreation
  ○ Creates a place for the community to mingle and come together to relax. This is a common feature for all ABC Waters sites.
  ○ The reservoir has become a popular recreational ground for the community to jog, fish, and take part in water sports like kayaking, canoeing and dragon boat racing.
  ○ The Family Bay Water Play Area provides fun activities for the young.
  ○ The stone seats look out into the water way for a panoramic view of the water sports competition or race.
• Ecology
  ○ Creates an environment for natural habitats near the rain gardens, bioretention swale and water bodies.
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Station 2: Heritage Deck – Heritage Panels

Duration: 30min
Location: Heritage Deck Heritage Panels
Learning Points:

- Recount historical events at Sungei Seletar up to the present day Lower Seletar Reservoir
- Compare and contrast past and present environment in Lower Seletar and give reasons for the changes
- Develop appreciation for the heritage and culture of Lower Seletar through the ABC Waters Programme at Lower Seletar Reservoir

Trainer's Notes	Cross Reference/ Materials
1. Activity: A Walk Down History • Brief students on the learning outcomes of these activities for this station. The content covers an integration of the humanities subjects namely historical, geographical cum social studies aspects. Refer to the Learning Points listed above on this page. • Give students about 10 minutes to revisit the history of Lower Seletar Reservoir by reading the historical information on the Heritage Panels. • Students will then respond to the reading by completing appropriately the speech bubble in the comic strip in pairs or in trios within their groups and discuss with the facilitator for a quick check. • The answers given must show understanding. On completion, proceed to the next activity in this station – Comparing the Past and Present. • Use the give suggested questions and answers to help you to facilitate the learning station. • Finally, discuss the learning point questions after the comic strip and comparison activities. **Suggested questions and answers for the comic strip speech bubbles:** • Picture 1: 1612. What are the earlier names for Seletar and the language that played a part in its name? (Selitar, Sletar or Saleata which means straits from the Malay word Selat. The name is believed to be derived from the ancient Sanskrit word Sri Lohita and the Arabs read it as Shelaheth.) • Picture 2: 1847-1848. What do the Orang Seletars trade for? (They bartered the herbs gathered in exchange for tobacco and kerosene.) • Picture 3: 1850s. What was grown as represented by the farmer Ah Beng at that time? (Cultivated gambier and pepper but was taken over by popularity of rubber and pineapple.) **2. Activity: Comparing the Past and Present** • This activity requires some prompting by the facilitator using the common characteristics given in the booklet in order to expedite the process. • First, get students to record their information in all the boxes in the past column. This information can be obtained from the Heritage Panels and some clues found in the booklets timeline. • After they have recorded the information in the given boxes indicating the past,	Pg 7 Pg 7-8

students observe the surrounding area for clues to the present scenario.

- **Facilitator's guidance is much needed here to help students translate their thoughts into words. Do not give the answers immediately.** Refer below to suggested questions to help students formulate their thoughts with the thinking process and the answers for the discussion.

Describing the Similarities Pg 8

- Students think of features that existed in the past that is linked with the present. This may prove difficult if they cannot see any link. Draw their attention to the river activity they see before them as a starting point.
- *Question: What activities do you think are being carried out here most of the time?* (Kayaking, canoeing, dragon boat racing and perhaps fishing if there are some anglers doing it at that time.)
- Use the function of the river Sungei Seletar in the past and focus on the activities then.
- *Question: What was the river used for in the past?* (For transport by sampans or kayaks – could be for recreation too. There was fishing going on too as there were kelongs then (The evidence is in the Heritage Deck itself that has been built to retain the culture of water activities and kelongs of the past – part of the ABC Waters Programme to preserve the heritage of the place.))

- Get students to draw the close parallel by stating two similarities and write them in the appropriate box.
- *Question: What similarities do you see in the type of navigation craft and activities that is still present today?* (The water activity using kayaks and canoes is still very much a feature in the river, be it using modern craft or ancient mode of navigating. There is still fishing along the river – seems a popular activity past and present. River till today still supplies us with water – it is still a catchment area but beautifully developed under the ABC Waters Programme.)

Describing the Differences Pg 8

- The students have already answered the boxed information for the past (refer to above). Then ask students to record the differences they observe for each characteristic of comparison given in the booklet.
- Students could brainstorm on the differences in the physical environment, current activities and mode of transportation.
- They will record at least two differences in the respective columns in the booklet.
- Description of the past is to be inferred from reading the information on the Heritage Panels whereas information to describe the present is based on what they observed and inferred on the spot.

a) <u>Physical Environment</u>
Questions:
  - Would you describe the environment as rural or urban as compared to the past? Why?
  - Could you give evidence from around you that it has been urbanised? Can you suggest how Lower Seletar Reservoir contributes to the urbanised environment?

Suggested answers:

Category	Past	Present
Landscape	• Rural environment mainly forested areas and in later years, there were plantations – rubber and pineapple.	• Place has become more urbanised – most of the forested areas and plantations have been removed and replaced by man-made parks, a reservoir and recreational ground such as Lower Seletar Park and Reservoir (developed by PUB) and Yishun Stadium, directly opposite the reservoir.
Settlements	• Generally, linear settlements. Tribes lived in boat houses with no proper housing along the Sungei Seletar. Villages are found along it too. These were single storey homes made of wood as depicted in the photos in the Heritage Panel.	• The nearby nucleated HDB estates (Yishun and Khatib) have replaced the rural settlements. These are high rise buildings made of concrete. The residents here are the immediate community to benefit from the ABC Waters facilities in Lower Seletar Reservoir. The ABC Waters Programme plays a part in developing the settlement in this environment.
Population	• Lower population density. Perhaps a quieter place with less people including nomadic tribe (Orang Seletar).	• Higher population density. Rather busy with more people residing in housing estates as Singapore's general population increases.
Amenities	• Has few or basic amenities as indicated by the type of settlement, mainly villages.	• Have more facilities and beautiful modern amenities in and around the HDB estates like the Orchid Country Club and golf course, which integrates with the picturesque landscape of Lower Seletar Reservoir. It faces the pristine nature reserve of Khatib Bongsu.

b) <u>Activities</u>
Questions:
- What river activities were the people in the past engaged in?
- What were all these activities in the past related to?
- What activities do you see here today that is different?
- What are they related to?

Suggested answers:

Past	Present
• Orang Seletar were skilful hunters and had extensive knowledge of the forest. Fishing seemed to be another predominant activity. They barter the herbs collected for tobacco and kerosene.	• The Orang Seletar has moved to Johor to join the Malay Community there or immerse with our local Malay Community. Activities are no longer primary but tertiary in nature, with commercial and recreational services.
• Later farming activities like growing Gambier and pepper started on 44 acres of leased land, followed by cultivation of rubber.	• Housing, recreation and commercial activities have taken over the plantations as indicated by shops, a reservoir and country club.
• All these activities were mainly related to their livelihood and occupation.	• All the activities in the immediate area relate more to recreation and sports. E.g. Lower Seletar Reservoir and park, gold course and a sports stadium and as a water catchment to supply water to the community.

c) <u>Transportation</u>

Questions:

- What was the main way people travelled along Sungi Seletar in the past?
- Is Lower Seletar still used as means of transportation?
- Why is there still water navigation in the reservoir?

Suggested answers:

Past	Present
• Orang Seletar navigate by boats.	• The Sungei Seletar is now used as a catchment area for storing water and recreational ground for the community under the ABC Waters Programme.
• Even up to the 1970s, not many can afford a car and they still travel along the village using small sampans (pedal boats).	• Kayaking, canoeing and dragon boat races.

- **A point to note**: To encourage creativity in the discussion, students could photograph the present changes and paste it in the respective boxes. However they should be encouraged to write a short description of the change depicted in each photo taken versus the past scenario.

- Discuss the learning point's questions.

- Question: Why do you think changes have taken place?
  Suggested answers:
  - Man changes his environment to meet basic needs, in this case, the need to meet sufficient water resources for Singapore in light of population growth.

○ Population increase creates need for better transportation, housing and recreation resources. ○ Hence the area has become more urbanised with better roads instead of boats, housing estates as opposed to villages or kampongs. ○ Most importantly, Active, Beautiful, Clean Programme to develop Singapore into a City of Gardens and Water.	

Station 3: Fishing Jetty

Duration: 20min
Location: Fishing Jetty
Learning Points:

- Describe the hydrological cycle in Lower Seletar and its importance to our catchment
- Identify the water treatment processes in Lower Seletar and its functions
- Collect samples of water to test for its quality following standard parameters
- Emphasise the importance of good quality water for all forms of life to survive

Trainer's Notes	Cross Reference/ Materials
1. The Water Cycle and Journey of Water from Lower Seletar Reservoir • Conduct this activity at the entrance of the fishing jetty. • Tap on students' prior knowledge of the water cycle by getting them to explain the processes. • Ask the question in the booklet, Pg 9 for discussion • Teacher summarise their information and explain the water journey and water loop at Lower Seletar.	Pg 9
2. Where does the water in the reservoir go? Suggested answers: • Rainwater on our surfaces will mostly runoff and collect into canals and drainage systems. • They may be filtered by rain gardens or bioretention swales or other natural features along the way. • These may be channelled into our reservoirs. • At the catchment, water is pumped into the pumping station to be pumped to the waterworks for treatment. • The end product is potable water for human consumption piped to the surrounding areas or sent to factories as industrial water.	Pg 9
3. Water Quality • Bring students to the **water collection point** (open space at the end of the fishing jetty) to observe the water: o What do they think the water quality is like - good or poor? (Answers vary.) o Why does the water in a reservoir need to be of good quality? (It is a source for our water supply, to support aquatic life.) • Tie the rope of the pail to the railing and collect some water. Pour the water into one water kit and bring students to a shaded area to put down their bags. • Ask students to turn to the pages 10 and 11 of their booklet. Explain why we carry out this water testing – to see what the water quality in the reservoir is like. It needs to be good as it is for our water supply and sustains aquatic life. The water testing activity during this trail is not an extensive one, but we will have a quick indication of water quality for that day and hour. • **Conduct a demonstration** on how to use the water kits. You may also use the data loggers brought by the school. Introduce the World Water Monitoring test kit. Pour water from the pail into an emptied water kit to the fill-line. Highlight that	Pg 10-11

for accuracy, the water needs to be filled exactly to this level. Run through the water parameters progressively, as in pages 10 and 11, explaining each parameter as you go (what each parameter is and some implications of the readings). Demonstrate how the Dissolved Oxygen (D.O.) and pH tests should be conducted.

- After your demonstration, assign the teams and distribute the test kits to each team.
- Collect more water from the reservoir in a pail to distribute to the students. Ensure that no student is allowed to collect water directly from the reservoir and that no equipment falls into the reservoir. Give teams 10-15minutes to complete their tests and record their answers in the "observation" boxes in their booklets. They should not fill in the "analysis" boxes yet. You will analyse the results of all the teams after they have obtained their results.
- After teams have obtained their readings, gather everyone for debrief. Ask them to give you their D.O and pH bottles. Place these together and start debrief.
- Discuss the readings obtained and **evaluate the state of the reservoir water**.

  Expected results:
  - **Debris and Smell** – there should not be any smell. "Nothing" is not considered a good answer as there is usually a natural smell for reservoirs and ponds, due to algae, soil particles and other natural materials in the water. There should not be any oil, rotting, etc. smell as this would indicate pollution. Analysis: natural if there is no oil or rotting smell.

  - **Colour** – the water should be slightly green or yellow in colour (due to the presence of some algae, which is normal). Analysis: normal. Some algae is good as this can add to the level of dissolved oxygen in the water.

  - **Turbidity** – this should be as clear as possible. The usual reading is the lightest or second lightest number. Reiterate that turbidity is caused by small particles suspended in the water. It affects the light penetration in the reservoir. The clearer the water, the higher the light penetration – allowing more aquatic plants/algae to grow in the reservoir.

  - **Temperature** – expected results is between 28 – 30^{o}C. Ask students what factors can affect water temperature (expected answers: weather conditions, rain). Reiterate that temperature can affect the amount of dissolved gases, like dissolved oxygen.

  - **Dissolved Oxygen** – this should be at least 4ppm (parts per million), below which the water will be too low poor to support aquatic life.

  - **pH** – pH of 6.5 – 8.2. The water may be slightly acidic as it is fed from forest streams which have dissolved tannins (from leaf litter).

  - Additional points: There is normally no oil film on the surface or things floating on the water (perhaps some organic matter – remnant of twigs and leaves).

- Summary: Ask students to answer the 3 questions at the bottom of page 11:
  - Conclusion: Overall quality of the water. (Expected answer: generally good)

○ Can you drink the water from this reservoir? Why? (Expected answers: No. Even though the water is generally of good quality and is able to support a rich community of aquatic life, the water still has to go through a series of treatment processes before it is suitable for drinking to remove bacteria and other microorganisms.) ○ Where does the water in Lower Seletar Reservoir come from? How do these parameters affect the water quality in the reservoir? (Surrounding catchment area in the Yishun and Kranji neighbourhood. The rainwater flows as runoff through a series of urban drains and eventually enters the reservoir. In the areas closer to the forest reserve, the water is fed from the forest streams, possibly making it more acidic due to the presence of tannins.) ○ What are the limitations of this water testing activity? (Only one measurement was taken at the water's surface at one time of the day. For more comprehensive testing, we need to test water from different depths, at different times of the day and from many locations throughout the year. Also, the water testing kit is limited in terms of accuracy.) • How can we help maintain good water quality in our water bodies? (By not polluting our waterways e.g. not littering, not pouring chemicals, not feeding fishes, etc.)	

Station 4: Litter Trap by the Canal

Duration: 20min
Location: Litter trap by the canal
Learning Points:

- Identify the impact of human activities on our water and biodiversity
- Identify the pollutants, sources and their impact on the water
- Suggest ways to minimise the negative impact of these activities

<table>
<tr><th>Trainer's Notes</th><th>Cross Reference/ Materials</th></tr>
<tr><td>

1. Keeping Lower Seletar Active, Beautiful and Clean

- Conduct this activity around the canal opening next to the wooden bridge.
- Allow students time to observe the canal, especially the water and describe what they see.
- Get them to describe the condition of the water.
- Ask students where they think the water could have come from and where it will be stored.
- Students then identify the activities in the surrounding areas, in and around the reservoir and describe their impact on the water quality.

- Question: Where do you think the water from this canal come from? (From the surrounding housing estates like Yishun and Khatib.)
- Question: What activities in or around Lower Seletar can affect the quality of our water in the reservoir?

<table>
<tr><th>Activities</th><th>Impact</th></tr>
<tr><td>Kayaking / dragon boat racing</td><td>Pollute water by spitting and introducing bacteria into water and dumping unwanted stuff. This may also choke aquatic life.</td></tr>
<tr><td>Picnickers</td><td>Cause land and water pollution when picnickers leave their food wrappers around or throw them into the drains. Ultimately, these will be washed by rain or blown by wind into the water.</td></tr>
<tr><td>Jogging</td><td>Similar impact as picnickers.</td></tr>
<tr><td>Fishing</td><td>If life baits are used, these will pollute the water as the bait is a living organism or cause the water to smell.</td></tr>
</table>

2. Observe the Litter Trap in the Canal

- Students proceed to the litter trap next to the canal and read its function on the signage in order to answer the questions on pg 13.
- Elicit responses from students by questioning the purpose of the litter-boom.
- Guide students to answer the questions in the booklet by filling up the type of pollutant they see, infer the source and suggest the impact.
- To take note that there may not be litter in the boom as the rubbish may have been cleaned up for that particular day of the trail.
- Students can still make suggestions on the type of pollutant it may trap.

</td><td>Pg 12

Pg 12

Pg 13</td></tr>
</table>

- Question: Ask why the location of the litter trap is found at the mouth of the canal. (This is to trap solid litter and remove it before it enters the reservoir. Helps to reduce the pollution in the reservoir.)

3. Brief discussion on what can be done to help minimise the pollution with students.

- Question: What solutions can you suggest to solve the mentioned problems?
- Suggested answers:
  - At the national level:
    - Heavier littering fines can be imposed.
    - Public education through exhibitions, brochures and talks on the role of the community in protecting our reservoirs.
    - Schools and private enterprises – involvement in looking after parks to foster a sense of ownership and pride.
    - Recognising the public's effort in playing their part to care for the waterways by introducing some form of award.
  - At an individual level:
    - Organise a Community Involvement Programme with friends to volunteer clean up the nearest catchment from your home.
    - Educate your friends by volunteering to run a trail in your nearest catchment and introduce them to the ABC Waters Programme.

Station 5: Rain Garden / Bioretention Swales

Duration: 20min
Location: Rain Garden / Bioretention Swales
Learning Points:

- Comprehend the function of rain garden and bioretention swales as natural features to clean water
- Identify the various components that make up the rain garden and bioretention swales
- Acknowledge its benefits to the environment and the promotion of biodiversity

Trainer's Notes	Cross Reference/ Materials

1. ABC Waters Design Features – Rain Garden
• Get students to stand around the Rain Garden and read its function on the signage.
• With the aid of the materials in the booklet, explain the following using questions.
  ○ What are rain gardens? (They are bioretention basins. Vegetated and with a depression designed to detain and filter rainwater.)
  ○ Can you describe the features of the garden as shown in the cross-section? (Detention element, sedimentation, filtration and biological uptake)
• Students respond to the explanation by answering the questions in the booklet.
• Teacher discusses their responses and clarifies doubts rain gardens.
• Question: You have learnt about water pollution and fertilisers causing algae bloom. How can rain gardens help to manage these environmental issues?
• Suggested answers:
  ○ Fertilisers from the catchment that have been washed into waterbodies served as nutrients for algae.
  ○ This promotes the excessive growth of algae, which reduces the amount of sunlight penetrating through the water to aquatic plants.
  ○ When dead algae and plants decompose, oxygen is consumed, thus depriving other aquatic life of oxygen.
	Pg 14
	
	Pg 15

2. ABC Waters Design Features – Bioretention Swales
• What are bioretention swales?
  ○ Approach this section in a similar way as the above.
  ○ Use materials provided in the booklet to help in the explanation.
  ○ Discuss the benefits.
• Suggested answers:
  ○ Plants grown in the Rain Garden are selected for their nitrogen and phosphorus uptake ability.
  ○ They will then take in the excessive nutrients and thus acts as a filter for the water before it is released into the waterways or water bodies.
  ○ Thus it curbs or checks algae growth and keeps the water clean.
	Pg 16

3. Animals at Lower Seletar Reservoir • Recap on the benefits of Rain Garden – encourage habitat creation and promote biodiversity. • Allow students time to roam around the Rain Garden and Family Bay area to	Pg 17

identify the biodiversity in the area. • Students then answer the question on pg 15. • Question: The reservoir and the Rain Garden is a habitat for animals and insects. What have you spotted here? (Refer students to pg 17 to tick what they can spot. Get students to name the birds and insects.) 4. Should there be time constraints, cover either the raingarden of bioretention swales. The other can be mentioned very briefly by the facilitator.	

Debrief and Reflection

Duration: 20min
Location: Family Bay Water Play Area
Learning Points:

- Summarise key points of the five ABC Waters Learning Trail stations
- Reflect on learning points of the ABC Waters Programme

Trainer's Notes	Cross Reference/ Materials
1. Reflection • Teachers and students meet together for the reflection and debriefing. • Students sit in their respective groups to do the recap of the learning. • Get students to summarise key features of the ABC Waters Learning Trail @ Lower Seletar by eliciting from students the key points for every station using questioning techniques. This could be done briskly in two different ways, namely: o As individual groups, each conducted by the teachers involved. o Or each group select two learning stations to share what they have learnt. o To prevent duplication or over subscription of a station for the sharing, the teacher could assign the stations to the different groups. • The 5 learning stations – get students to name them and briefly state what they have learnt at each station. a) Heritage Panels on the Heritage Deck: Recount history of the place and comparing the changes made. Give at least one reason for the change. b) Viewing Gallery on the Heritage Deck: How they feel about the physical beauty of the landscape. c) Fishing Jetty: The water cycle at Lower Seletar. What do you understand about how and where all the storm water goes? d) Family Bay: Impact of activities on the water and keeping our waters clean. Get students to suggest practical measures to reduce the impact of these activities. e) Rain Garden and Bioretention Swales: State an interesting fact about Rain Garden and Bioretention Swales, e.g. it is a natural way of cleaning our waters and enhances the biodiversity in the garden and surrounding area. It also slows down the flow of water so that it will filter into the ground.	Pg 18
2. Discussion • Get students to do reflection followed by discussion of their answers. • Question: What is your understanding of the ABC Waters Programme? • Suggested answers: o Transform all our network of drains, canals and reservoirs into beautiful, clean and active places. o Besides supplying us with clean waters, recreational space and focal points are created for families to enjoy. o While recreating the landscape, the history of a place is kept and integrated with the new environment. • Question: The nation's vision is to transform Singapore into a City of Gardens	Pg 18

and Water. What have you observed here about the reality of the vision?
• Suggested answers:
  ○ The physical aspect of this vision has been materialised in that the reservoir is more than just an area of storing water but it has doubled up as a park where biodiversity can be observed.
  ○ It is also a place for the community to indulge in active water sports and other recreational pursuits like jogging, cycling, kayaking, canoeing etc.
  ○ The environment is clean and as picturesque as a postcard or postcard pretty.
 	
• Question: How can you encourage visitors to care for Lower Seletar Reservoir and other ABC Waters sites?
• Suggested answers:
  ○ Through the grassroots – engage them to organise a bonding activity for residents at the reservoir followed by Community Involvement Programme – a cleanup.
  ○ School's adopting the reservoirs and conduct combined activities with the nearby schools to better appreciate the place, e.g. conduct Community Involvement Programme activities at the site, host a concert for the public to make it an attractive and valuable site.
  ○ Reward the community – to come up with suggestions to improve the place and reward them with meal coupons from fast food joints, when it is implemented.
	Pg 18

Reinforcement Activity (Optional) – Our Precious Waterways

Duration: 30min
Location: Family Bay Water Play Area
Learning Points:
To reinforce through the game:

- The ABC Waters Programme concept of an active, beautiful and clean catchment for all to enjoy as a community
- That the bill of health of our waterways depends on the community to look after them
- To take pride in our waterways and protect them as out of a sense of ownership of our environment

To take note: Game will take 30 minutes. To have more time for this game, debrief and reflection will need to be completed sooner.

How to Play the Game?

The task
To collect water for their assigned reservoirs (represented by the pails) and keep it clean from all kinds of pollution. Using the plastic bags perforated with 6-8 holes, the assigned members of each group will collect water from the water sprouts and water wheels, (located in the Family Bay water play area), to fill up their pails (reservoirs).

The challenge
While water is being collected, an assigned group member will have to protect their pail of water from being dirtied or polluted by a member of another group. The latter will constantly throw rubbish to pollute their "reservoirs". The rubbish can be litter or grasses collected from the nearby area. The protector of the group must try their best to prevent the pollution from happening.

The winner will be the group with the cleanest or least pollutants in their "reservoir" and of course, with the most amount of water as well.

Rules

- There should not be any toppling of each other's pail of water. A penalty of 5 points will be deducted from the overall amazing trail score.
- Once when the game has stopped, there should not be any more last minute throwing of litter into another group's pail, when the pails of water are being lined up for judging.

Equipment / Materials needed for the game

- A plastic pail or any waterproof receptacle to represent the reservoirs for each group.
- 10 cm by 10 cm plastic food bags with at most 8 punctured holes.
- Litter for the "polluter" of each group.

Number of participants and assigned roles

- 5-8 participants per group.
- 4-5 water collectors, depending on the overall group size, to represent our drainage network.
- 1 protector of the pail of water to represent a responsible and active member of the community who always helps to keep the water clean.
- 1 polluter to represent an irate, irresponsible, indifferent or nonchalant member of the community, enjoying the amenities but not bothering about its upkeep.

Number of facilitators / teachers and assigned roles

- 2 facilitators / teachers to co-ordinate and control activating the water sprout and water wheels. They can activate them simultaneously, do it alternately so as to make the participants run for the water or a combination of both ways.
- 2 facilitators / teachers to be sideline judges to ensure safety and prevent foul play when playing the game.
- 1 facilitator to be the referee and instructor for the game.
- All facilitators to be the adjudicators to select the winning team / group.

Extension Activity – Line Debating Activity

Duration: 1 – 1.5 hours

This can be conducted as a post-trip activity in class or a wet weather programme at a sheltered area.

Learning Points:

- To give students opportunity to articulate and communicate their thoughts and opinions in a convincing manner about the given motion.

Trainer's Notes	Cross Reference/ Materials
1. Divide the class into two teams with five speakers to represent each team. 2. The team captain will draw lots to determine the stand for the motion. 3. Two-three adjudicators are needed to judge the debate based on a certain set criteria for judging. 4. Refer to the student booklet for the activity. 5. Judging criteria a) Content and clarity of argument (10 marks) b) Presentation and delivery (10 marks) c) Rebuttal (10 marks) d) Team effort / team work (10 marks) Total: 40 marks	Pg 19

References

- Water for All. Conserve, Value, Enjoy – Meeting our water needs for the next 50 years. PUB Public Document (2010).
- Tan Yong Soon, Lee Tung Jean and Karen Tan (2009) Clean, Green and Blue. Singapore's Journey Towards Environmental and Water Sustainability, Ministry of the Environment and Water Resource.
- Active, Beautiful, Clean Waters Design Guidelines, PUB (2009 and 2011).
- PURE magazine, PUB. (Sep 2010).

Annexes

Annex 1: Preparation Brief for ABC Waters Learning Trail

Suggested What-to-bring List (Print only if you have to)

For students:

1. A small bag pack or knapsack
2. Water bottle – 500ml of water
3. A hat/cap with a broad brim for extended sun shade
4. Ziploc bag for water-proofing valuable items (e.g. digital camera, handphone)
5. Stationery – Clip board, pencil/pen
6. Electronics – Digital camera/handphone with camera function
7. A hand towel
8. Suggested attire: School/physical education T-shirt and shorts, track shoes and a spare change of clothes

Do not bring:

Digital hand held gaming devices, text books, sports equipment for the fieldtrip.

For trainers:

1. All of the above items
2. Star stickers for the amazing race
3. Plastic pails – 6-8 pails
4. Plastic food bags with punctured holes
5. First-aid kit
6. Insect repellent
7. 4-5 sets of compasses
8. 4-5 pails with rope attached for collection of water
9. Water Monitoring Kit
10. pH strips, turbidity discs, thermometer and dissolved oxygen tablets (to bring if no Water Monitoring Kit)
11. Plastic bag to collect used pH strips and water which has been tested
12. (optional) Rainforest Guide books, bird/insect ID cards
13. Suggested attire: Comfortable jeans/bermudas/track pants with cotton T-shirt

Annex 2: Suggested Information for Risk Assessment Management (RAM) Form

Risk Assessment Management System
'W Checklist'

PROGRAMME DETAILS			
Activity:	ABC Waters Learning Trail	**Venue:**	MacRitchie Reservoir
Outgoing		**Returning**	
Date:	To be filled by teacher	**Date:**	To be filled by teacher
Estimated Time of Departure:	To be filled by teacher	**Estimated Time of Arrival:**	To be filled by teacher
Person-in-charge:	To be filled by teacher	**Assistant(s):**	To be filled by teacher

LOCAL VENDOR CONTACT DETAILS (IF ANY)			
Company name & full address:	Facilitator's Name Singapore Environment Council 1 Kay Siang Road #04-02 Singapore 248922		
Office number:		**Mobile number:**	HP of facilitator
Contact person:	Facilitator's name		

OVERSEAS VENDOR CONTACT DETAILS (IF ANY)			
Company name & full address:	NA		
Office number:	NA	**Mobile number:**	NA

Contact Person:	NA
WHY	
State learning objectives: This programme aims to: 1. Foster a sense of national identity and emotional rootedness to Singapore 2. Learn about the Singapore Water Story, appreciating Singapore's unique challenges and successes 3. Understand one of PUB's long term initiatives – the ABC Waters Programme, which will transform Singapore's pervasive network of drains, canals and reservoirs into beautiful and clean streams, rivers and lakes 4. Better understand ecological and water topics in the Science syllabus 5. Promote stewardship for our strategic water resource and the need for everyone to play a part to keep our waterways and reservoirs active, beautiful and clean	
Does the activity meet learning objectives? (Yes / No)	

Note: *Please attach the programme / itinerary.*

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
WHAT (GENERAL)									
1.	**Equipment**								
	a) Appropriate equipment is available.								
	b) Appropriate equipment is serviceable.								
	c) Others :								
2.	**Transport**								
	a) Transportation service is reliable (e.g. driver, vehicle).						To be filled by teacher		
	b) Chartered vehicle is appropriate (e.g. using a 4WD for off-road terrain).						To be filled by teacher		
	c) Others :								
3.	**Food**								
	a) Food is provided by licensed caterer / restaurants.								
	b) Nutrition is appropriate.								
	c) Special dietary needs are met.								

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
	d) If self-catering, additional hygiene measures are in place.								
	e) Water is potable.								
	f) Others :								
WHEN (TIMING)									
4.	**Programme**								
	a) Duration of activity is appropriate (e.g. start/stop/rest time).	Participants tired out from the activity	Dehydration/ Physical exhaustion	2	1	2	- The trail will last for 2 hours in the outdoors, with activity stops at the stations.		
	b) Timing of activity is appropriate (e.g. 5km run conducted before 10.30am or after 3.30pm).	Possible heat injuries due to weather	Dehydration/ Physical exhaustion	2	1	2	- Activities at stations will be conducted in shady areas or under available shelter. - Students will not be under the sun for a prolong period of time. - Students will be reminded to hydrate frequently.		
	c) Possible delay in activity (e.g. day hike extended into night).	NA							
	d) Others :								
WHO (PEOPLE)									

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
5.	**Teachers and Adult Supervisors**								
	a) Teacher(s)/adult supervisor(s) are competent to supervise activity and manage participants (e.g. teacher/adult supervisor: participant ratio met for specific activity, female adult supervisor present for overnight activity involving female participants).	Participants fall sick and need attention/ evacuation	Not enough teachers/ adult supervisors	2	1	2	- Facilitators are experienced in supervising/managing students - Program ratio will be 1 facilitator to 20 maximum students.		
	b) Personnel is certified and competent to conduct activity.	Participants risk possible danger when outdoors	Participants may injure themselves	2	1	2	- Facilitators are experienced in conducting activities for students in indoor and outdoor settings.		
	c) Certified First Aider or paramedic is on site.	Injured students do not get the proper first aid.	Minor injuries could manifest to major injuries if not treated well.	3	1	3	- Facilitators are first-aid certified. (please verify) - Should there be any student who is injured, he/she will be accompanied by a teacher/parent volunteer to the nearest shelter to be attended to by the main facilitator.		
	d) Personnel is competent to co-ordinate/execute emergency evacuation plan (e.g. search	Students with serious injuries cannot get to the	Injuries could be life threatening.	4	1	4	- Should there be a medical emergency involving the injured student, the main facilitator will call		

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
	and rescue).	hospital in time.					for an ambulance and the teacher/parent volunteer will accompany him/her to the hospital.		
	e) Others :								
6.	**Participants**								
	a) Participants understand the objectives of activity.						- A briefing will be given at the start of the Learning Trail.		
	b) Participants are competent for activity (e.g. participate in pre-activity training).								
	c) Participants are aware of and adhere to safety requirements of activity.						- A SAFETY briefing will be given at the start of the programme. Facilitators will reiterate safety points during the programme, when necessary. - Students will be briefed to react if they encounter potentially dangerous animals e.g. snake, monkeys, etc. - Students will be briefed not to enter water bodies; not cause anyone to fall into the water bodies. - Water collection for testing will not		

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
							be carried out by students, but only by facilitators or teachers.		
	d) Special needs of participants are met.								
	e) Medical declaration and information of participants are documented and disseminated to relevant personnel.						- Teacher/s to inform facilitators about any special cases – students with medical conditions.		
	f) Others :								
WHERE (LOCATION)									
7.	**Venue**								
	a) Accommodation is adequate (e.g. number of rooms).								
	b) Fire safety and evacuation route is communicated to all.								
	c) Area map is available for use during activity.	Students find themselves lost.	Injuries may ensue.	1	1	1	- Map of location is included in the student booklets. These are carried by both facilitators and students during the programme. - Students should be with the		

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
							facilitators at all times.		
	d) Reconnaissance of area is conducted.	Dangerous hazards appear in between time of recon and actual day	Injuries may ensue due to unforeseen hazards.	1	1	1	- Facilitators would have conducted a reconnaissance of the location before the date of the learning trail.		
	e) In-country authorities and facilities (e.g. police, national park rangers and hospital) are accessible and/or contactable for assistance and support in the event of an emergency.								
	f) Water conditions (e.g. tides, currents, flash floods) and traffic (e.g. ships, power boats).								
	g) Others :								
WEATHER									
8.	**Inclement Weather**								
	a) Weather forecast and warning (e.g. lightning, flash flood, hot or cold spell, haze).	Sudden down-pour	Participants get drenched which will cause participants to fall	1	1	1	- Facilitators to check NEA Rain animation and PSI level at these timings: o 2 hours before LT		

S/n	Categories to consider:	Hazards Identification		Risk Evaluation Score			Risk Control: Strategies to reduce risk to an acceptable level	Implementation	
		Possible hazards	Potential incidents/ accidents	Severity (a)	Likelihood (b)	Risk level (a) x (b)		Action Officer	Follow-Up Date
			ill eventually.				○ 1 hour before LT ○ During LT if needed		
		Lightning	Participants strike by lightning	4	2	8	- Before students board bus for the location: In the case of **impending thunderstorm, heavy rain or levels of PSI above 100**, it is advised to delay the departure for the location, until Lightning Category 1 is lifted. - If there is **Lightning category 1 or PSI level of equal or greater than 100 during the Learning Trail,** all activities will be stopped and students will be led to take shelter. - If the conditions persist, the programme will be aborted and students brought back to school.		
	b) Others :								

***Note**: Please indicate "N.A." in cells that are not applicable.*

Excursion Checklist		Action Plan	Implementation	
			Action Officer	Follow-up Date
1.	**Communication**			
	a) Establish communication with school and service provider via hand phone, satellite phone and/or other appropriate devices.			
	b) Establish communication with in-country authorities and facilities (e.g. police, national park rangers, hospital) for assistance and support in the event of an emergency.			
	c) Compile contact list of stakeholders (e.g. parents, MFA Duty Office, and in-country medical facilities).			
2.	**Medical**			
	a) Arrange for medical screening and vaccinations for teachers/adult supervisors and participants (if necessary).			
	b) Procure comprehensive travel insurance for all (e.g. International SOS for emergency evacuation).			
	c) Ensure accessibility to medical facilities or personnel in the event of an emergency.			
3.	**Overseas Travel**			
	a) E-register with MFA at least 3 days before departure.			
	b) Monitor and comply with MFA travel advisory on natural disasters, pandemic outbreak, social-political unrest.			
4.	**Others**			
	a)			

Risk Assessment Team comprises:

Name of Officer(s)	Designation

Name of Person-in-charge	Signature	Date

Vetted by:

Name of HOD	Signature	Date

Chief Safety Officer/Principal Checklist

To ensure that the following are completed prior to the programme:

- ☐ Communicate programme details to parents and participants
- ☐ Compile medical information and consent forms
- ☐ Ensure that personnel conducting activity is qualified
- ☐ Ensure that pre-activity training is carried out

☐ Ensure that relevant safety and emergency procedures are in place

Submission of Overseas Excursion details to MFA via MFA eRegister (if applicable):

☐ Prepare details of itinerary and participants for overseas excursion
☐ Enter details for BF01_MFA-MOE form via the Overseas Excursion Management (OEM) Module in the School Cockpit
☐ Generate the BF01_MFA-MOE form from the Reports Portal in the School Cockpit
☐ Submit BF01_MFA-MOE form as an attachment at www.mfa.gov.sg at least 3 days before departure

Approved by:

Name of Chief Safety Officer/Principal	Signature	Date
Comments:		

Assessment Review:

Name of Person-in-charge	Signature	Date

Annex 3: Subject Links

No	Theme	PUB's Educational Objectives	Lower Secondary School Curricula
1	Our Four National Taps and water supply and sustainability	Technology and an integrated approach for a robust supply of **WATER FOR ALL**	**Science – Chemistry** • Process of reverse osmosis in NEWater and desalination to get clean water **Geography** • Managing our changing environment in particular our water resources, rising demand of water and response to it • Case study of water management in Singapore
2	The ABC Waters design features of integrating ecology (green parks), hydrology (blue waters) and the community (the public) at Lower Seletar	Appreciating our active, beautiful and clean waters for **ALL TO VALUE AND ENJOY** by encouraging the community to play a responsible role in its upkeep	**English/Literature** • Use of descriptive genre to describe the beauty, buzzing activity and refreshing environment at Lower Seletar Reservoir • Situational writing – to create a blog or design a postcard for a friend • Inspiring poetry through writing an ode to Lower Seletar Reservoir **Geography** • Components of the physical and human environment • Important interrelationships and inter-dependence between man and his environment
3	Retaining the rich historical and cultural background of Lower Seletar Reservoir	Importance of history and culture despite urbanisation of Lower Seletar for all to **VALUE**	**History** • The history of Sungei Seletar • The growth and development of a place from a rural to an urban settlement **Geography** • The changing environment and factors responsible for the change • Skills in basic techniques namely, comparing and contrasting the changes and inferring information through photos and maps

No	Theme	PUB's Educational Objectives	Lower Secondary School Curricula
4	The water cycle and water quality at Lower Seletar	Clean **WATER FOR ALL**	**Science** • Process skills relating to testing and inferring **Geography** • Weather studies in particular the processes of water cycle in the atmosphere
5	Human activities and their impact	**WATER IS PRECIOUS. CONSERVE** the waterway at all times	**Science** • Conservation of the environment **Geography** • Water pollution – sources, impact and measures to curb or reduce the pollution • Conserving the environment namely at national and individual levels
6	Biodiversity at Lower Seletar Reservoir	Creating an environment for the biodiversity in Lower Seletar	**Science** • Classification of plants and animals • Conserving and protecting the natural habitat • Food chain in the natural environment **Geography** • Managing the environment • Conservation and measures to prevent an environmental crisis

Annex 4: Group Scoring Sheets and Trail Route

GROUP NAME: MACRITCHIE

Amazing Trail Route:
1. Heritage Deck Heritage Panels → 2. Heritage Deck Viewing Gallery → 3. Fishing Jetty →
4. Family Bay → 5. Rain Garden / Bioretention Swales → 6. End at Family Bay

	HERITAGE DECK HERITAGE PANELS		HERITAGE DECK - VIEWING GALLERY		FAMILY BAY		FISHING JETTY		RAIN GARDEN / BIORETENTION SWALES	
	Activities	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**
1										
2										
3										
4										
	SUB TOTAL		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**	
WATER GAME **/10 points** **5 points: for most water** **5 points: for cleanest water**							**GRAND TOTAL**			

Scoring Guide:

★= 2 points ★★= 3 points ★★★= 5 points

GROUP NAME: <u>PEIRCE</u>

Amazing Trail Route:
1. Heritage Deck Viewing Gallery → 2. Heritage Deck Heritage Panels → 3. Family Bay → 4. Fishing Jetty → 5. Rain Garden / Bioretention Swales → 6. End at Family Bay

	HERITAGE DECK HERITAGE PANELS		HERITAGE DECK - VIEWING GALLERY		FAMILY BAY		FISHING JETTY		RAIN GARDEN / BIORETENTION SWALES	
	Activities	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**
1										
2										
3										
4										
	SUB TOTAL		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**	
WATER GAME **/10 points** **5 points: for most water** **5 points: for cleanest water**							**GRAND TOTAL**			

Scoring Guide:

★= 2 points ★★= 3 points ★★★= 5 points

GROUP NAME: <u>PUNGGOL - SENGKANG</u>

Amazing Trail Route:
1. Fishing Jetty → 2. Family Bay → 3. Rain Garden / Bioretention Swales → 4. Heritage Deck Heritage Panels → 5. Heritage Deck Viewing Gallery → 6. End at Family Bay

	HERITAGE DECK HERITAGE PANELS		HERITAGE DECK - VIEWING GALLERY		FAMILY BAY		FISHING JETTY		RAIN GARDEN / BIORETENTION SWALES	
	Activities	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**
1										
2										
3										
4										
	SUB TOTAL		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**	
WATER GAME **/10 points** **5 points: for most water** **5 points: for cleanest water**							**GRAND TOTAL**			

Scoring Guide:

★= 2 points ★★= 3 points ★★★= 5 points

GROUP NAME: <u>UPPER SELETAR</u>

Amazing Trail Route:
1. Family Bay → 2. Fishing Jetty → 3. Heritage Deck Viewing Gallery → 4. Heritage Deck Heritage Panels → 5. Rain Garden / Bioretention Swales → 6. End at Family Bay

	HERITAGE DECK HERITAGE PANELS		HERITAGE DECK - VIEWING GALLERY		FAMILY BAY		FISHING JETTY		RAIN GARDEN / BIORETENTION SWALES	
	Activities	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**
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3										
4										
	SUB TOTAL		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**	
WATER GAME **/10 points** **5 points: for most water** **5 points: for cleanest water**							**GRAND TOTAL**			

Scoring Guide:

★= 2 points ★★= 3 points ★★★= 5 points

GROUP NAME: <u>MARINA</u>

Amazing Trail Route:
1. Rain Garden / Bioretention Swales → 2. Heritage Deck Heritage Panels → 3. Heritage Deck Viewing Gallery → 4. Family Bay → 5. Fishing Jetty → 6. End at Family Bay

	HERITAGE DECK HERITAGE PANELS		HERITAGE DECK - VIEWING GALLERY		FAMILY BAY		FISHING JETTY		RAIN GARDEN / BIORETENTION SWALES	
	Activities	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**
1										
2										
3										
4										
	SUB TOTAL		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**	
WATER GAME **/10 points** **5 points: for most water** **5 points: for cleanest water**							**GRAND TOTAL**			

Scoring Guide:

★= 2 points ★★= 3 points ★★★= 5 points

GROUP NAME: <u>BEDOK</u>

Amazing Trail Route:
1. Fishing Jetty → 2. Rain Garden / Bioretention Swales → 3. Family Bay → 4. Heritage Deck Viewing Gallery → 5. Heritage Deck Heritage Panels → 6. End at Family Bay

	HERITAGE DECK HERITAGE PANELS		**HERITAGE DECK - VIEWING GALLERY**		**FAMILY BAY**		**FISHING JETTY**		**RAIN GARDEN / BIORETENTION SWALES**	
	Activities	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**	**Activities**	**Group Score**
1										
2										
3										
4										
	SUB TOTAL		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**		**SUB TOTAL**	
WATER GAME **/10 points** **5 points: for most water** **5 points: for cleanest water**							**GRAND TOTAL**			

Scoring Guide:

★= 2 points ★★= 3 points ★★★= 5 points

Acknowledgement

Anglican High School

PUB, Singapore's national water agency

PUB is the national water agency that manages Singapore's water supply, water catchment and used water network in an integrated way. PUB won the 2007 Stockholm Industry Water Award and was named Water Agency of the Year at the Global Water Awards 2006.

About PUB's tagline: Water for All: Conserve, Value, Enjoy

PUB has ensured a diversified and sustainable supply of water for Singapore with the Four National Taps (local catchment water, imported water, NEWater, desalinated water).

To provide water for all, PUB calls on all Singaporeans to play our part to conserve water, keep our water catchments and waterways clean and build a relationship with water so we can enjoy our water resources. We can then have enough water for all uses – for industry, for living, for life.

PUB SINGAPORE'S NATIONAL WATER AGENCY

www.pub.gov.sg